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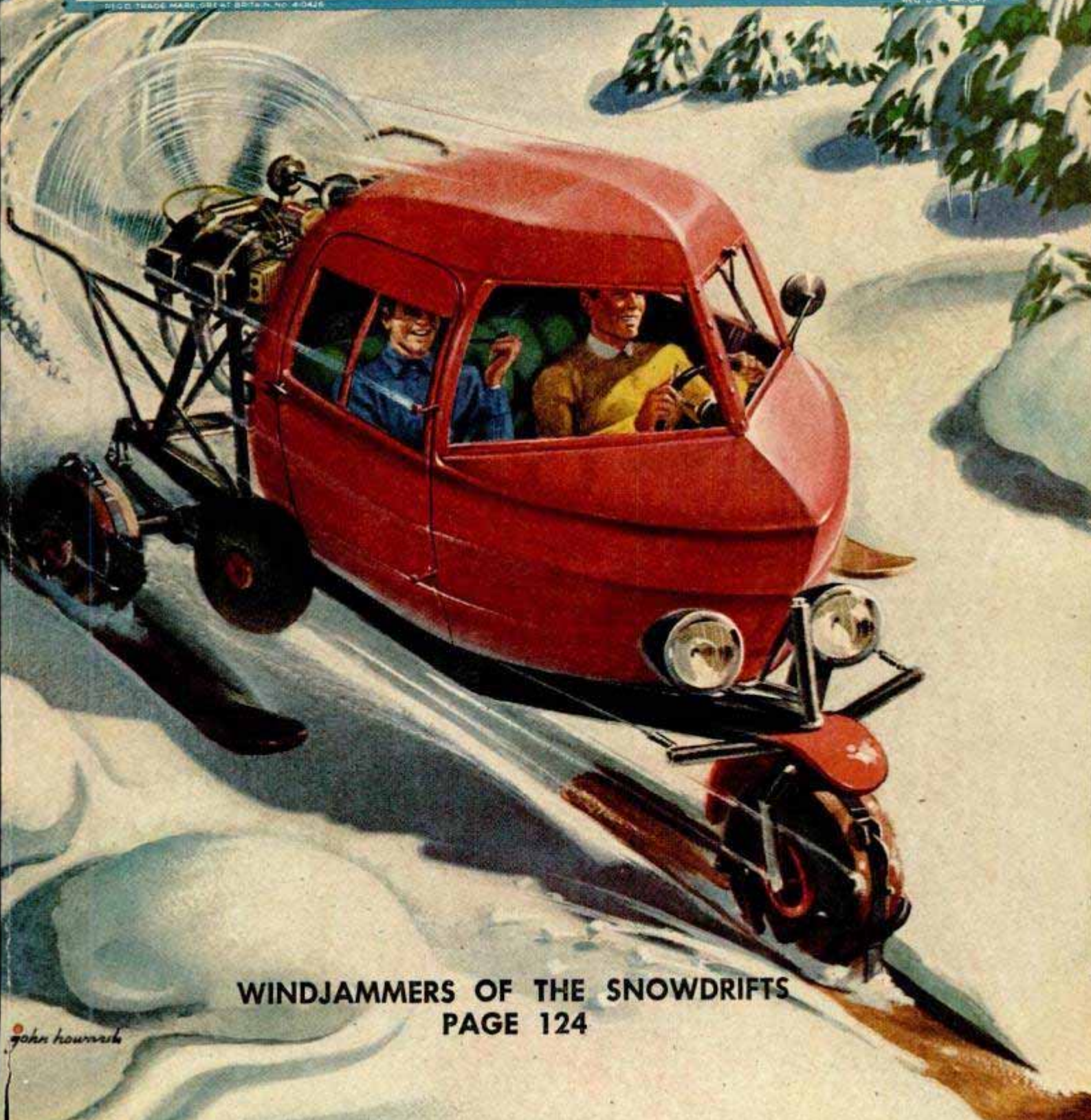
POPULAR MECHANICS

MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

REG. TRADE MARK GREAT BRITAIN NO. 40426

REG. U.S. PAT. OFF.



WINDJAMMERS OF THE SNOWDRIFTS
PAGE 124

John Hounsch

Dependable

CHAMPION

America's Favorite Spark Plug



In rendering invaluable service to all America, the trucking industry must keep detailed records of operating and maintenance costs. That's why fleet operators are qualified experts on spark plugs. It is extremely significant that the majority of leading fleets everywhere prefer and use dependable Champion Spark Plugs.



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Listen to the CHAMPION ROLL CALL . . . Harry Wismer's fast sportscast every Friday night, over the ABC network

Research Keeps
B.F. Goodrich
FIRST IN RUBBER



Typical example: user's experience with B. F. Goodrich tires

THIS PICTURE shows Frank H. Neely of Columbus, Tennessee, pointing out how much tread is still left on a B. F. Goodrich tire, one of a pair, that he says has traveled over 30,000 miles on his Chevrolet coupe. Mr. Neely writes that these tires "look to be good for as many more miles before replacing". And he should know what he's talking about, because he has two other B. F. Goodrich tires on the same car that he says are still running at more than 58,000 miles.

We don't claim you'll often

get 58,000 or 60,000 miles on any tire. That sort of mileage depends on a lot of things. Proper inflation, for instance. Keeping wheels in line and balanced right. Shifting tires from wheel to wheel to even up on wear.

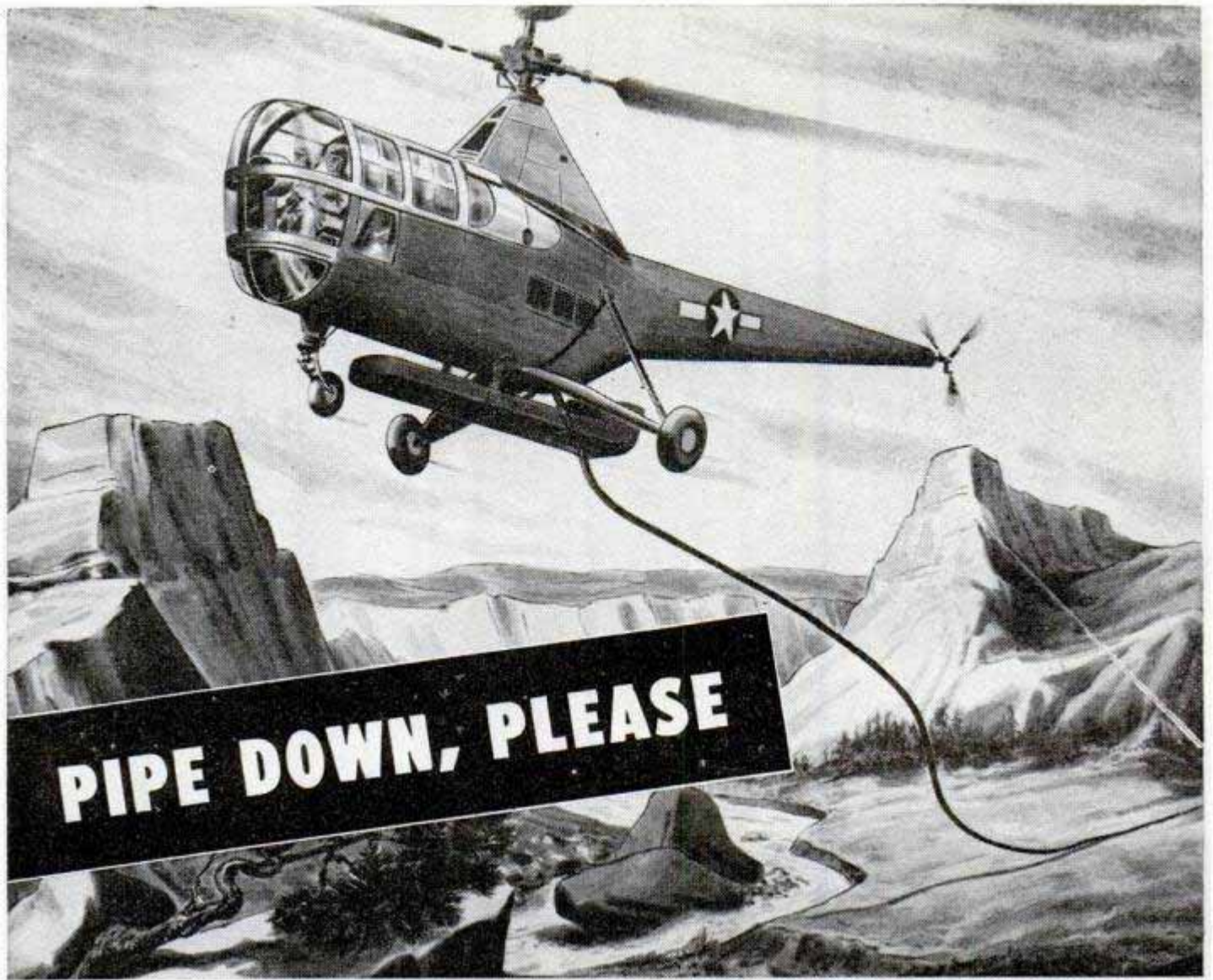
But here's what we do claim, and we can back it up with photographs and statements such as Mr. Neely's: B. F. Goodrich tires not only outwear others; they *do* outwear prewar tires.

From shoulder to shoulder the tread is wider and flatter. Weight and wear are distributed more

evenly over a greater area. The tougher tire body has a double shock-absorbing breaker strip.

This is a good time to buy tires. Why not get a set of four new sharp treads for winter driving? Turn your old tires in for a good allowance. If you don't know your B. F. Goodrich dealer's name look under "tires" in the yellow section of your telephone book. *The B. F. Goodrich Company, Akron, Ohio.*

B.F. Goodrich
FIRST IN RUBBER



This "egg-beater" is laying a continuous pipeline of reinforced hose. An anchor is dropped, then the helicopter moves on and the line is paid out astern. Or sections of metal pipe are dropped where men on the ground can assemble them.

Credit the Army Engineers for this pipe-dream-come-true. Since the helicopter can go anywhere a man afoot can go—and some places where he can't—you don't have to build costly roads for heavy ground equipment. Savings in time and money add up.

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Next Month



HOW-TO-BUILD-IT plans for this smart cabin cruiser have been adapted for "back yard" builders by Assistant Editor Arthur Youngquist from a naval architect's drawings. The original model was constructed just before the war with materials which cost \$1500. It has a galley, can be built to sleep two or four persons and makes 15 knots. The boat was used as an "Admiral's barge" by the Coast Guard during the war. This ambitious boatbuilding project starts in the March issue and will intrigue both the hammer-and-saw and armchair builders.

OTHER Craftsman features will tell the fine points of laying a hardwood floor and how to build a sickle-bar mower which snug-gles right up to a fence post.

AERONAUTICAL engineers are testing planes that can climb 100,000 feet. At this height gasoline boils and the temperature may be 70 below zero. One odd problem is to keep the crew from roasting. A March feature tells how "They Blaze The Trail Into Space." A story about Alaska, "Bigger Than Texas," is a companion piece to the Hawaii feature in this issue.

RADIO students and experimenters will find an efficient up-to-date two-band 5-tube super in the 1948 "Little Giant" a.c. set in the Radio and Electronics pages.

Volume 89 FEBRUARY 1948 Number 2

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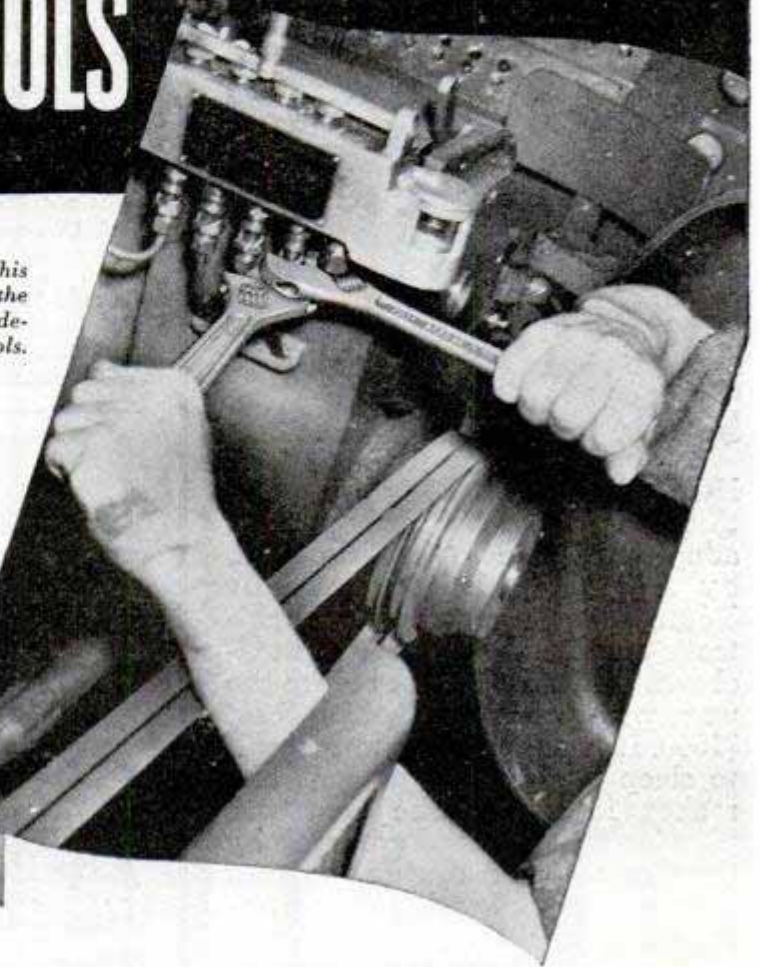
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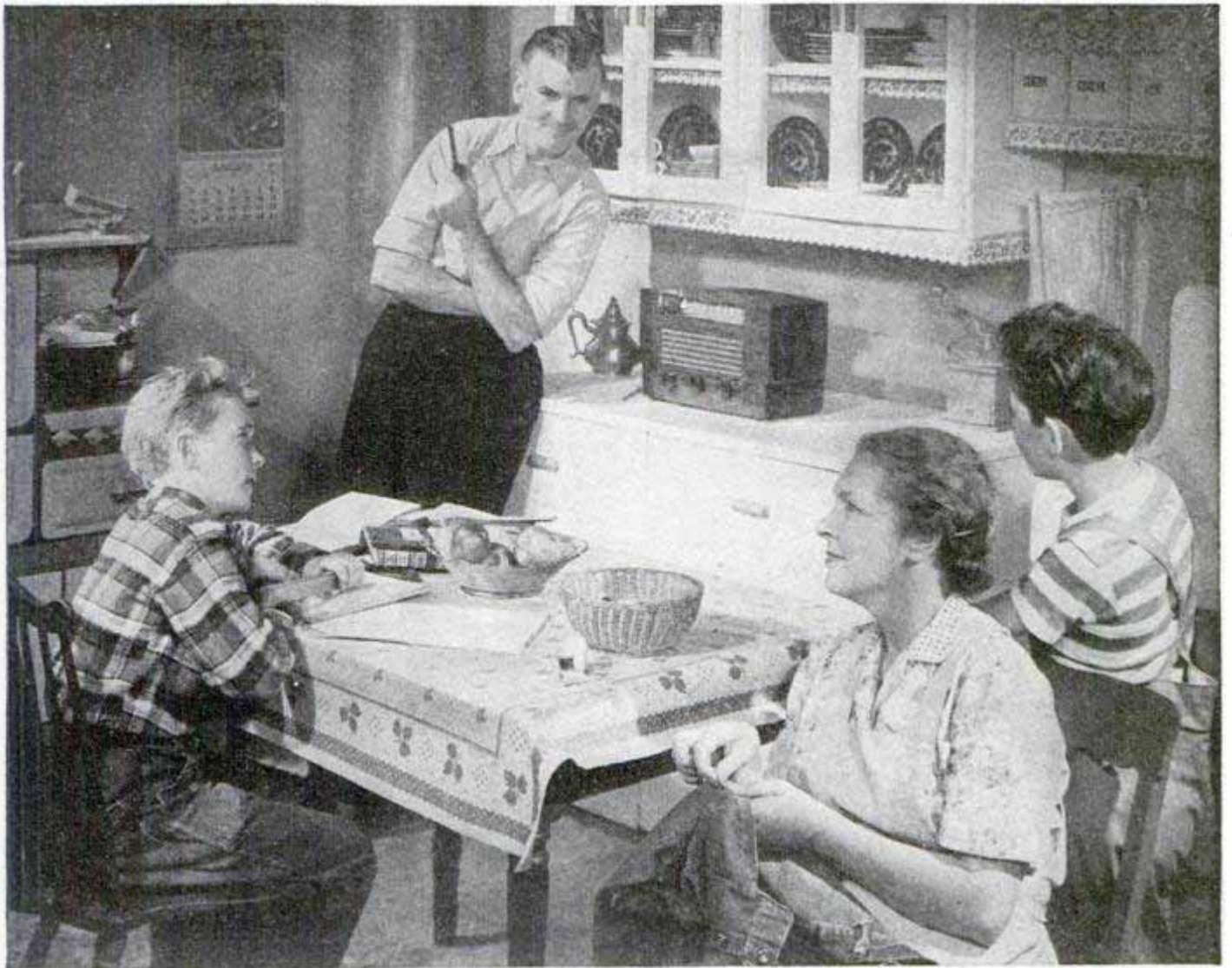
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As the world grows smaller, the question of international communications and world understanding grows larger. The most important phase of this problem is *Freedom to Listen* and *Freedom to Look*—for all peoples of the world.

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Radio should make a prisoner of no man and it should make no man its slave. No one should be forced

to listen and no one compelled to refrain from listening. Always and everywhere, it should be the prerogative of every listener to turn his receiver on or off, of his own free will.

The principle of *Freedom to Listen* should be established for all peoples without restriction or fear. This is as important as *Freedom of Speech* and *Freedom of the Press*.

Television is on the way and moving steadily forward. Television fires the imagination, and the day is foreseen when we shall look around the earth from city to city, and nation to nation, as easily as we

now listen to global broadcasts. Therefore, *Freedom to Look* is as important as *Freedom to Listen*, for the combination of these will be the radio of the future.

The "Voice of Peace" must speak around this planet and be heard by all people everywhere, no matter what their race, or creed, or political philosophies.*

David Sarnoff

President and Chairman of the Board,
Radio Corporation of America.

*Excerpts from an address before the U. S.
National Commission for UNESCO.



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FEBRUARY 1948



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Arthur Godfrey says:

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YOU'VE often heard Arthur Godfrey, famed "Huck Finn of Radio," now winning new renown with his coast-to-coast "Talent Scouts" and other CBS programs. But this is the first time you've heard the star on the subject of I. C. S.:

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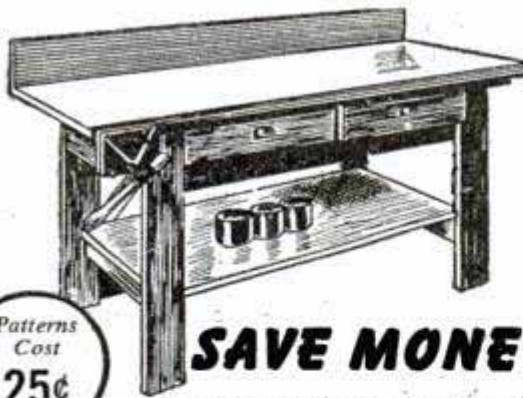
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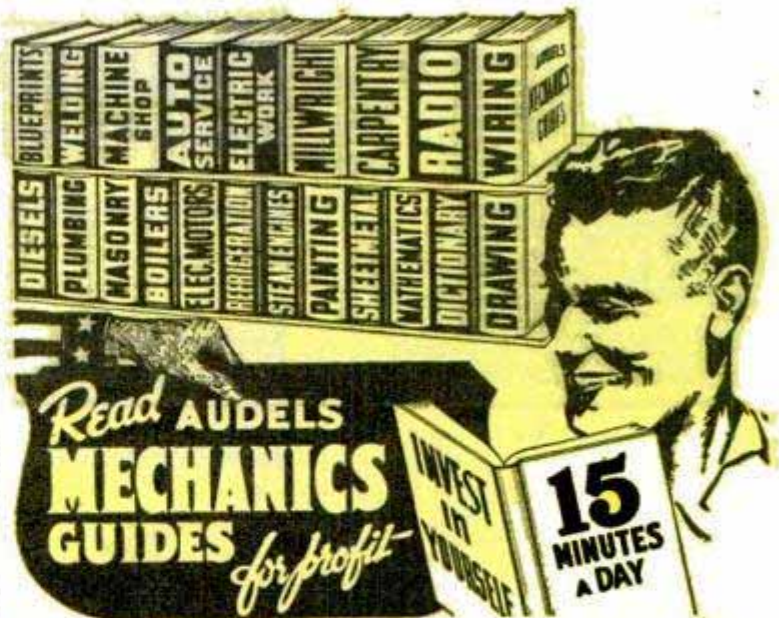
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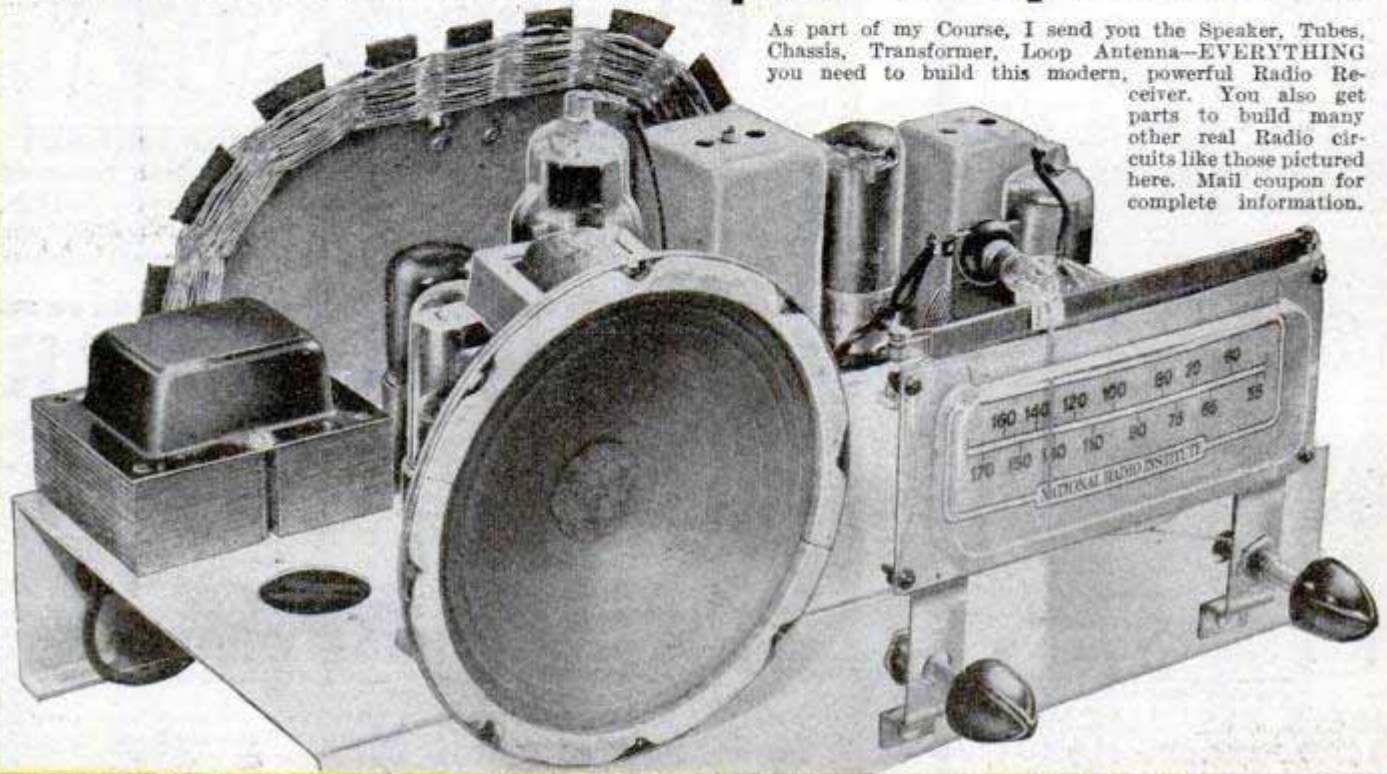
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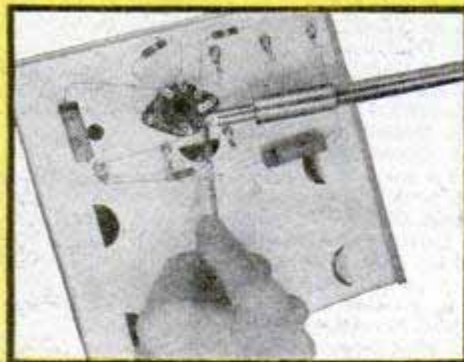
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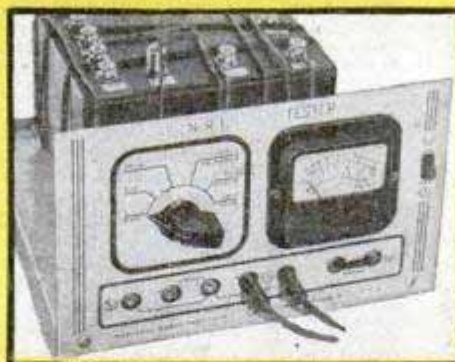
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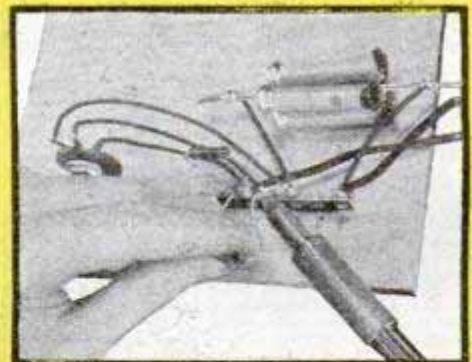
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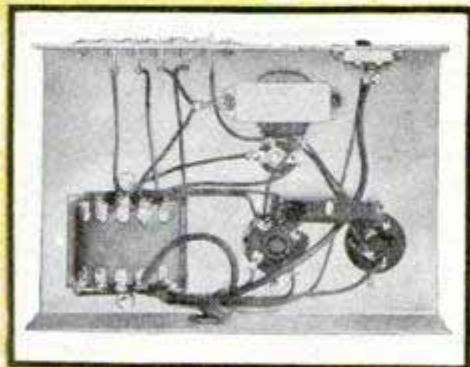
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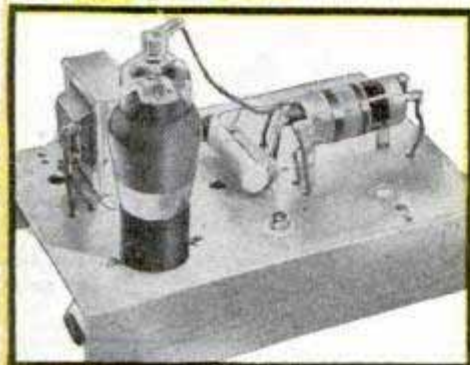


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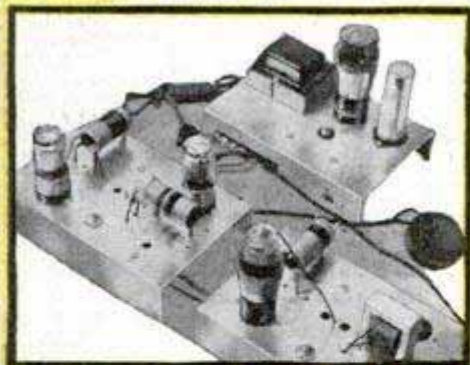
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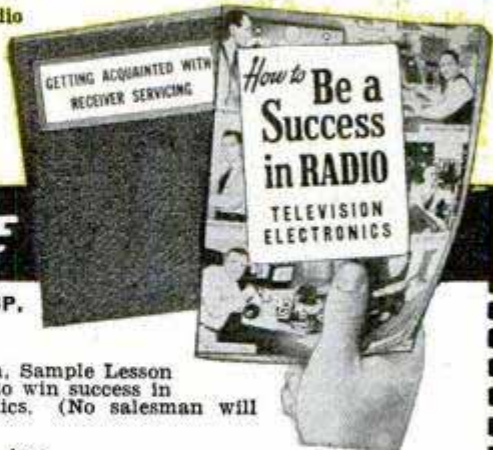
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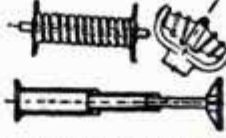
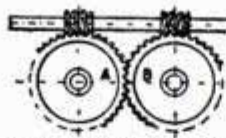
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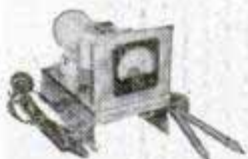
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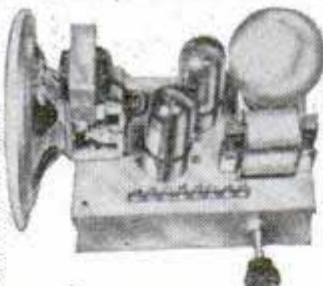
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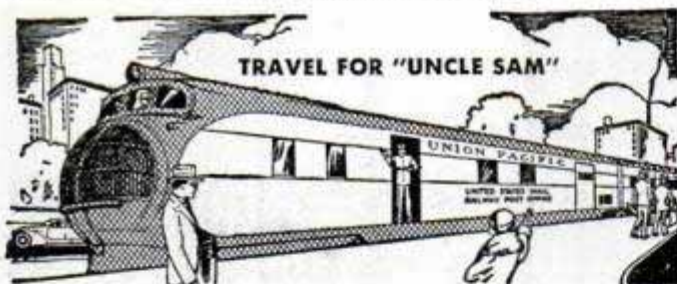
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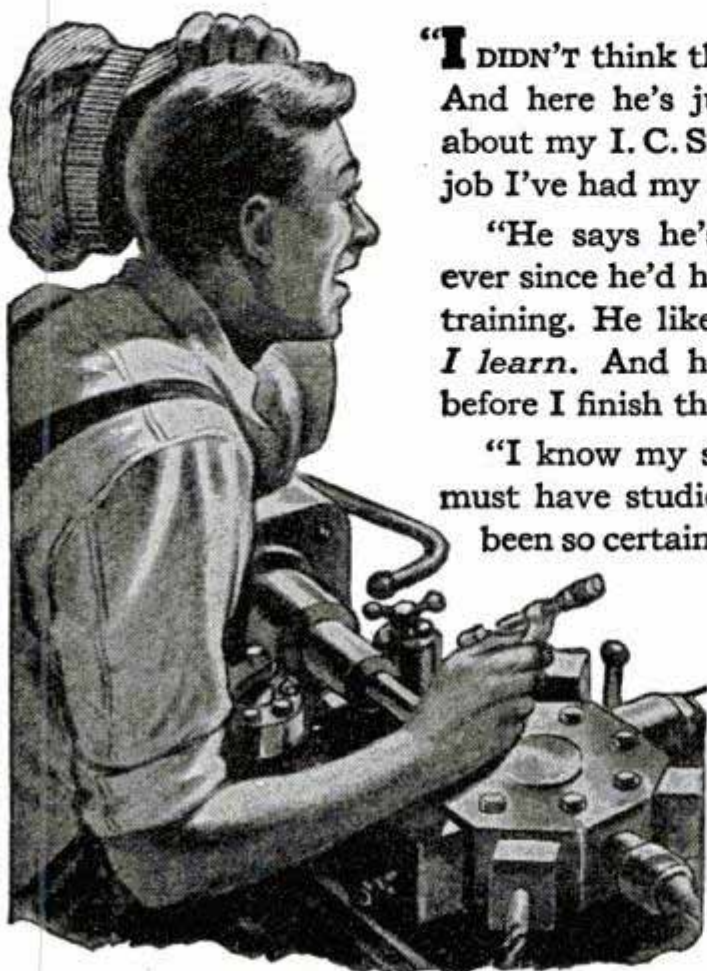
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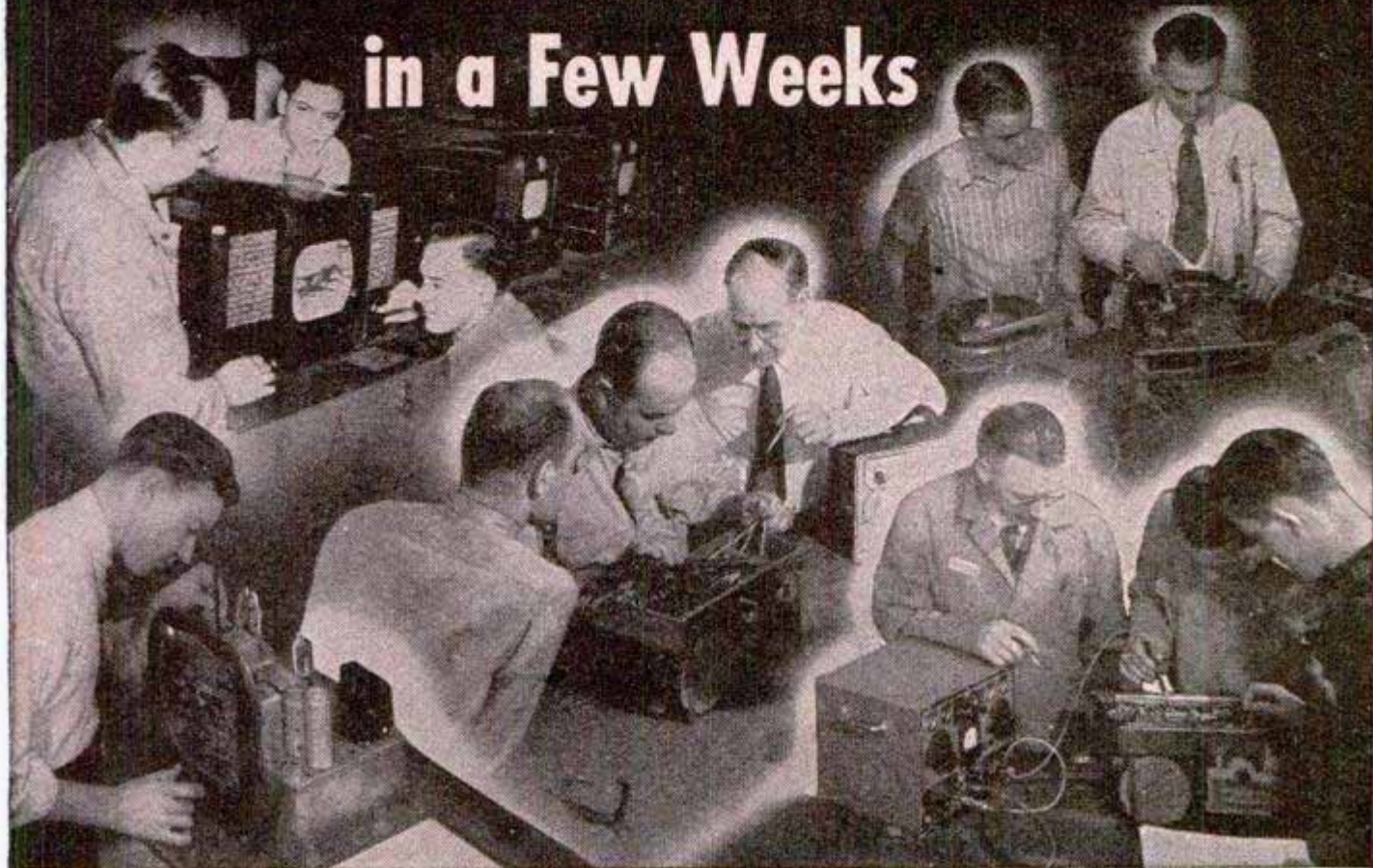
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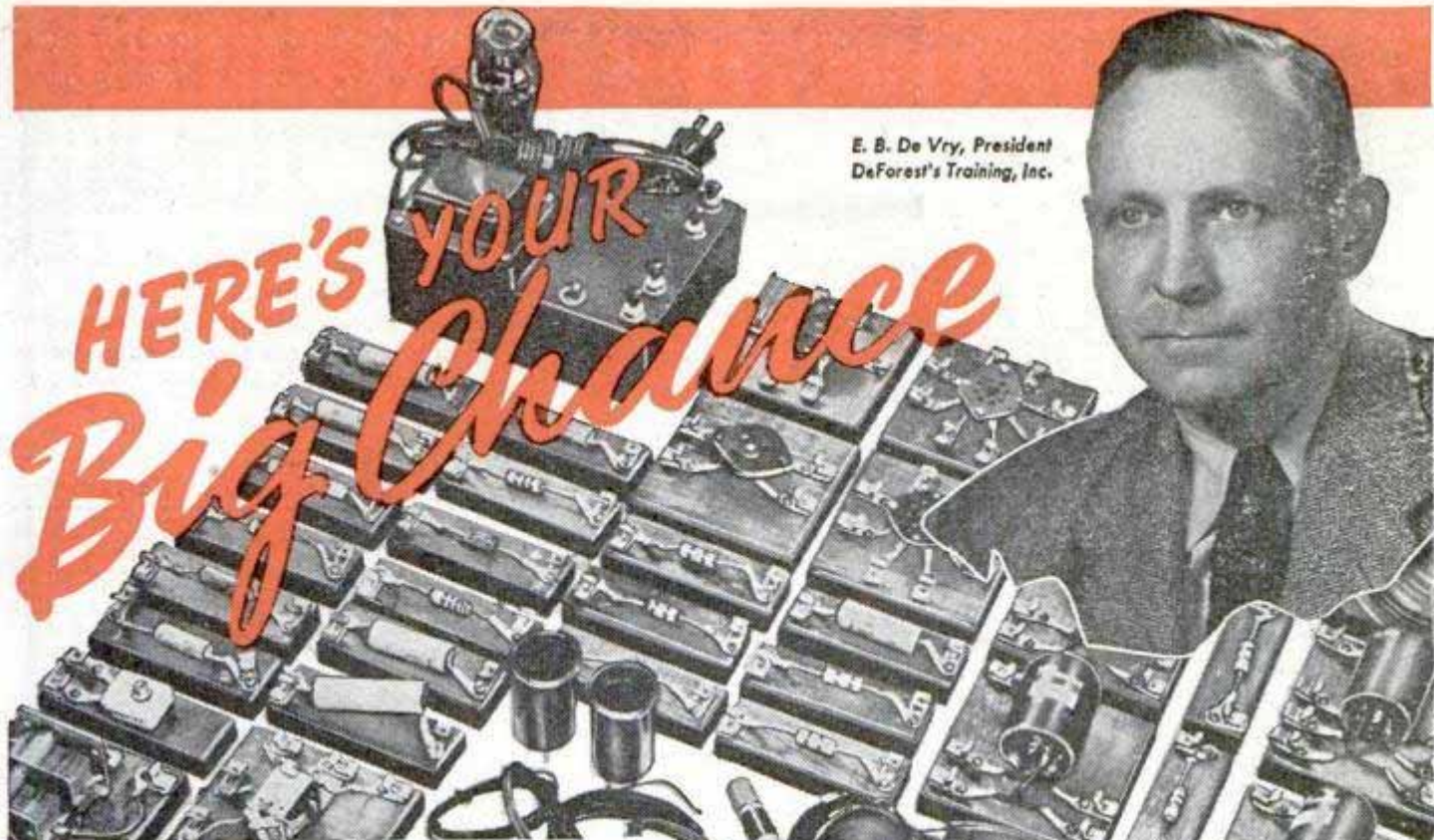
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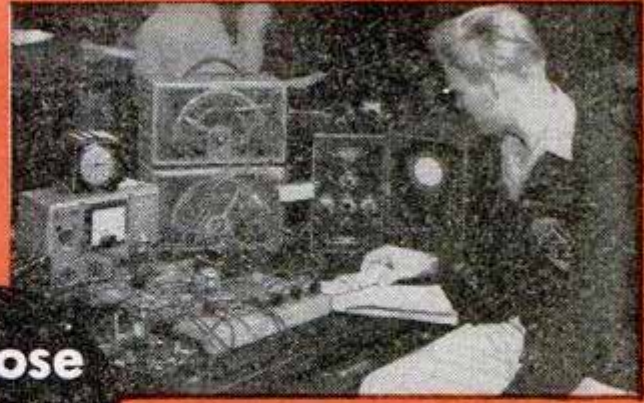
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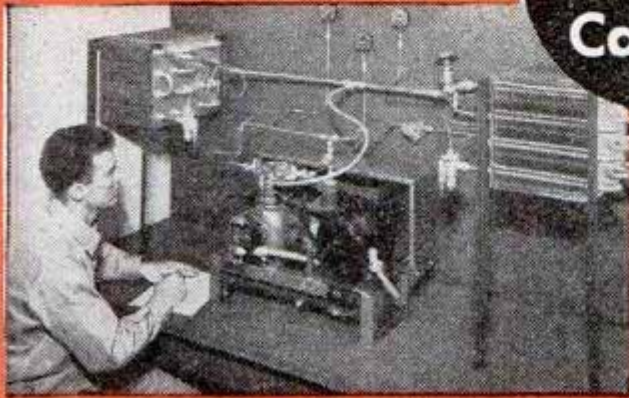


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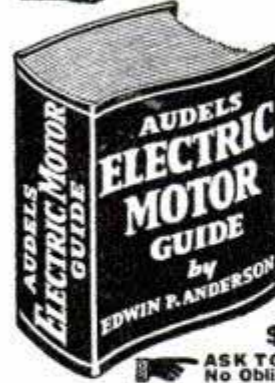
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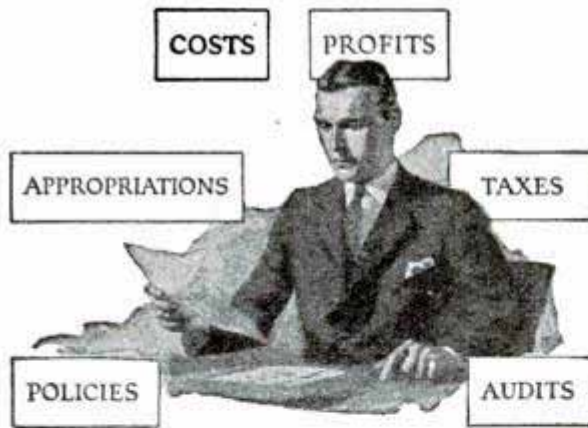
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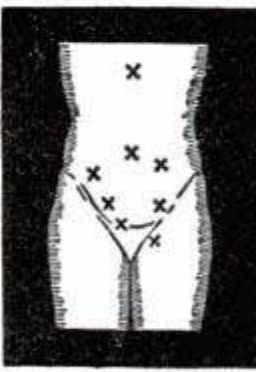
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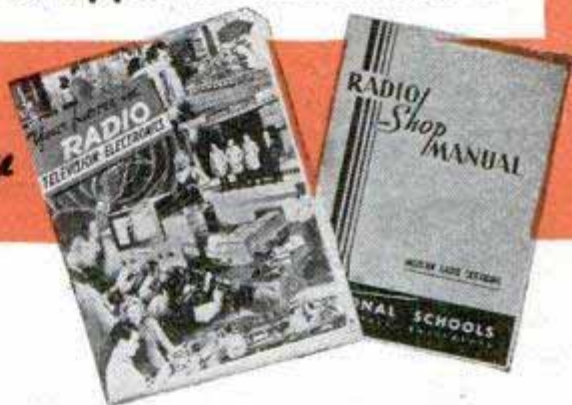


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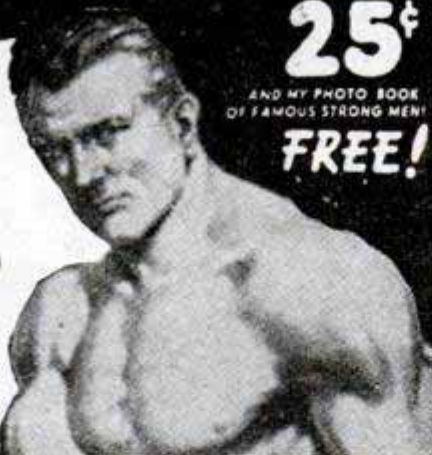
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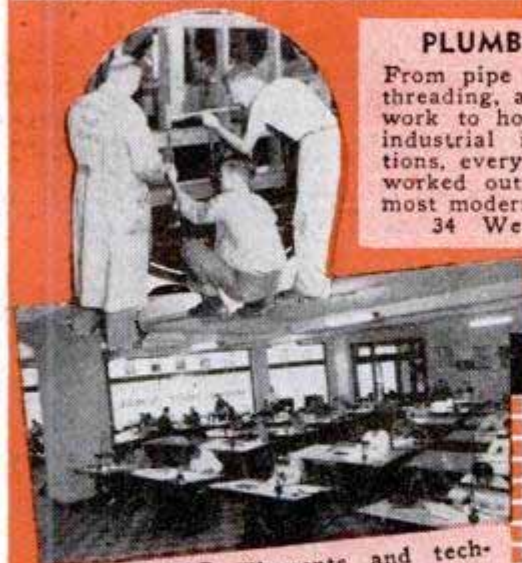
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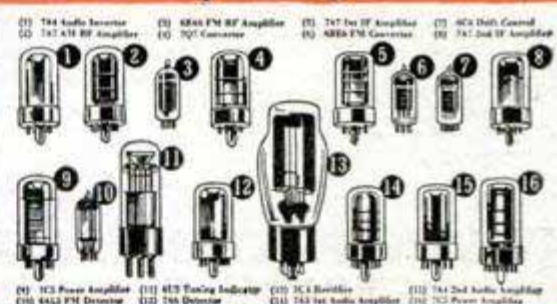
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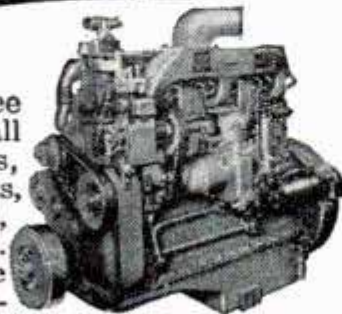
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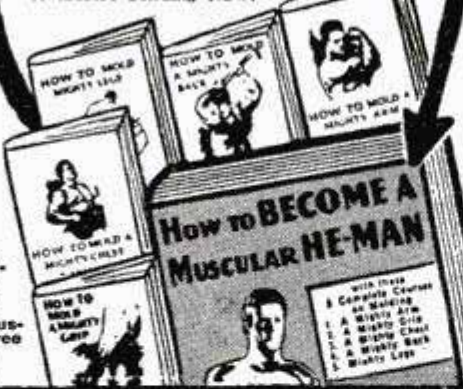
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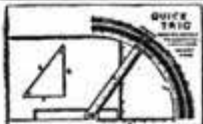
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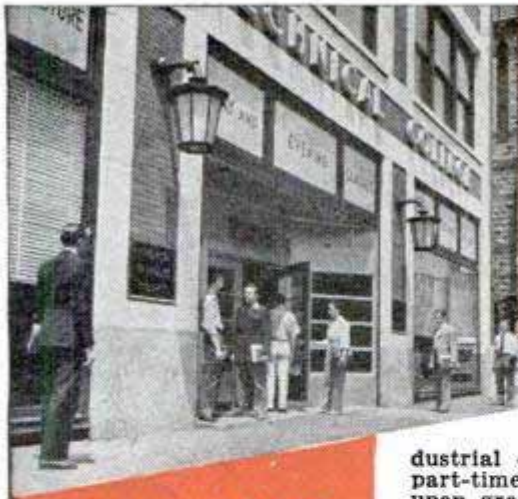
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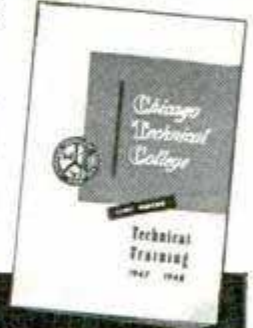
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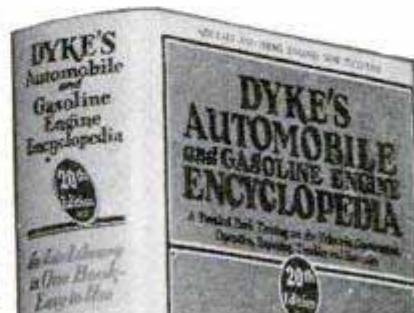
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WELDING Supplies—Electric and gas. 1/16" rod 15c doz., 3/32" 25c doz., 1/8" 30c doz., Carbons 1/4" 15c ea., 3/8" 25c ea. Welders gauntlet gloves \$1.95 pr. 110 volt welder complete \$17.85. New govt. surplus helmets with 3 lenses, \$3.85 ea. Gas welding outfit, complete \$57.00. Complete stock welders clothing, Sweeney, 7241 S. Halsted, Chicago 21, Ill.

A.C. Welders, 110 v. welds 1/2" steel. \$29. Morris Welding Service, 1850A State St., Schenectady 4, N. Y.

OXY-ACETYLENE Welding outfit including: Full oxygen and acetylene cylinders, \$72.95 complete, f.o.b. Cleveland, Ohio. New, supply limited. Check or deposit with order, balance c.o.d. Cylinders can be refilled anywhere. Ideal for hobbyists, garages, repair shops, etc., includes supply of rod. The Burdett Oxy-Weld Equip. Co., 3399 Lakeside Avenue, Cleveland 14, Ohio.

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30 AMP. Selenium plating rectifiers with Powerstat control, \$85.00. Lead lined tanks, geared motors for agitation. Complete line of bronzed baby shoe mounts. Hollywood Bronze Supply, 1770 N. Vermont, Hollywood 27, Calif.

MACHINERY, TOOLS AND SUPPLIES

WAR Surplus special: Big 50 lb. box popular size bolts, nuts, washers, screws, clamps, etc. \$6.85. War Surplus Co., Box 910, New Brunswick, N. J.

GEARS For inventors, experimenters, model makers, schools, work shops, laboratories, etc. Government surplus made of brass, bronze, dural steel and stainless steel. 12 matched pairs; 24 gears, bevel, spur and ratchet. List price \$12.00, our price \$2.50. 25 matched pairs; 50 gears, includes larger gears, also sets of worm gears. List price \$30.00, our price \$5.00. Limited quantity. Order now. Write for our bulletins on ball bearings, rectifiers, relays, selsyns, horns and government surplus materials MET Exchange, 323 Canal Street, New York.

SANDING Belt—Make your own. Inst. 40-220 grit; garnet or aloxide. 25 ft. 4" \$1.98, 6" \$2.50. Modern Products, 3919 S. S. St., Erie, Penna.

MACHINE Tool castings for woodworking and metalworking tools. Machine them yourself, save up to 80%. Catalog describing 23 Lewis tools and projects sent for 10c. Lewis Machine Tool Co., 3217 Union Pacific Avenue, Dept. M, Los Angeles 23, California.

SALVAGE Tools, high speed steel drills, bits, cutters. List with sample drills 15c. J. Dickey, Newfield, New York.

100 ASSORTED Scissor screws \$6.50. Scissor screw wrench \$2.50. Overland Saw Service, Independence, Iowa.

BEECO—The machine that sharpens lawnmowers like new. 4148 Cornwall, Berkley, Michigan.

TAPS, Dies, tools and supplies. Buy direct by mail. Free catalog. King Tap & Tool Co., North Attleboro, Mass.

REVOLUTIONARY Power tool saws or files with hand drill. Distributors wanted. Dongerson, Georgetown, Colorado.

HI-SPEED Drills, 25 piece assortment, number and fractional sizes to 1/4" \$2.00, to 3/8" \$3.00, to 1/2" \$5.00. H.S. tap assortment 10 for \$3.50, all sizes 1/4" thru 1/2". Decimal chart with orders. Lampke Surplus Tools, 11607 Linwood, Detroit 6, Mich.

HARDWARE, Tools, taps, dies, drills, pattern supplies, castings, electrical equipment, brass, steel, drill rod. Catalog 5c. Terek, 6304 Patterson, Chicago 34.

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FOOT Switch—Operates all power tools. Guaranteed. \$3.95, or two for \$6.49. Reb Industries, Dept. 265-DC, Elmhurst, Illinois.

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ELECTROPLATING Has a thousand and one uses when working with machinery, tools and supplies. Warner Electroplaters permit you to easily plate chromium, gold, silver, nickel, copper, etc. Plating equals costly commercial jobs. Pay for your electroplater in a short time by plating for others at a profit. Write today for free sample and literature. Warner Electric Co., Dept. MT-2, 1512 Jarvis Avenue, Chicago 26, Ill.

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DRILL Grinder for twist drills \$2.95. See ad on page 266.

SHEBEL Saw filer. Files all saws. Circular. A. P. Shebel, 730 B. So. 2nd St., Milwaukee 4, Wis.

HOME Lathe owners—Build your own attachments. Send for photograph, sample of work and list of blueprints. Cut gears, ratchets, etc. Make neat screws easy way. The Home Shop, 415 Raymond Ave., Glendale 1, Calif.

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FOR Sale—Keyway machine, use in electric drills, real machine tool, cuts 1/8 to 3/4 inch keyway. Seventy five dollars postpaid. Distributors wanted. Holt Equipment, Independence, Oregon.

DRILLS—Taps reconditioned, up to seventy-five percent off list. Send for free circular just published. Perry Screw and Bolt Corporation, 4250 Grand-River, Detroit 8, Michigan.

MECHANICS. Machinists, hobbyists—Amazing dual-drive assembly, geared 7 to 1 reduction, is driven by powerful 1/5 h.p. a.c. or d.c. motor, operates on 6-27, or 110 volts with transformer. Simple standard attachments convert this amazing unit into a dual, hand or table drill, polisher, buffer, router, sander, countless other uses. May be used as individual drill, sander, etc., by detaching flexible drive shaft. Complete with step down transformer, worth half the investment; which can also be used to convert nearly all aircraft motors to regular house current. \$300.00 value! While they last, \$19.50. No c.o.d. "Amazing Bachman's," 23 Herman St., Rochester 5, N. Y.

FOR Sale—Anvil, ideal for garage work or hobby shop, weight 22 pounds, six dollars postpaid. Holt Equipment, Independence, Oregon.

"WAR Surplus" bargains! All new! Flexible drive cables! Three sizes, 10"; 25"; 72". Over \$5.00 value. Combination offer of all three sizes, \$1.75. Precision built right angle drives. Complete with flexible drive cables. Only \$3.50. Magnet wire 1/2 lb. coils No. 22, 10 rolls for \$3. 27 volt geared head (120 r.p.m.) motor \$30.00 value; all new; special \$2.95. Bushings and spacers, all new, aluminum and steel. 25 variety assortment. Special! Minimum 5 pounds \$4.75. Bolt and screw assortment; over 50 varieties. Special! 5 pound \$4.75. Rivet assortment, copper, steel, aluminum, over 250 varieties. Extra special! 5 pound minimum \$4.75. Micro switches; new; 6 variety assortment. \$15.00 value, only \$4.75. Order today! No c.o.d. "Amazing Bachman's," 23 Herman Street, Rochester 5, N. Y.

CONCRETE Block machines \$39.50 up. Catalog free. Concrete Machine Company, 5466 Gravois, St. Louis 16, Missouri.

DRILL Grinder—Grinds drills to factory accuracy. Calipers with direct reading scales. Circle cutters. New Tool grinder. Lowest prices. Free literature. Factory, 811-B East 31st, Kansas City 3, Mo.

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GAS Drive arc welders. "Build your own." Portable, goes everywhere after profitable jobs. Free instruction book. Write Hobart Welders, Box M-284, Troy, Ohio.

1/4 H.P. Split phase, 110 volt, 1750 r.p.m., alternating current washing machine or general purpose motors, \$19.50 each. 1/2 h.p. per capacitor 110-220 volts, 1750 r.p.m., alternating current, heavy duty, for all purposes, \$32.00 each. Workshop Motors Company, Box 47, Berwyn, Illinois.

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CHEMICALS And apparatus for industrial, analytical and private laboratories. Complete supply service for correspondence school students. Send 10c for catalog. Dept. M-43, Biological Supply Co., 1176 Mt. Hope Ave., Rochester 7, New York.

FREE Catalog: Chemistry, mineralogy, physics, biology. Tracey Laboratories, Evanston, Illinois.

LABORATORY Supplies, chemicals, glassware, etc., low prices. Large catalog 15c. Microscopic stain catalogue 20c. Both for 25c. National Scientific Company, Established 1908, 2204 W. North Ave., Chicago 47, Ill.

CHEMICALS—LAB. Supplies. New catalog 10c. Mel-Glo Chemical Co., 258 Fourth Avenue, Brooklyn 15, N. Y.

APPARATUS, Chemicals, ounce quantities, catalog 10c. Fleischer's Laboratories, Everett 49, Mass.

NEW Laboratory supply catalog of chemicals and apparatus, contains over 5000 items with illustrations, 212 pages. Send 50c. Standard Science Supply Co., 1232 No. Paulina Street, Chicago 22, Ill.

HANDBOOK For chemical experimenters, illustrated, hundreds of experiments, 50c. Experiment booklet 15c. Supply catalog 5c. Reading Scientific Company, Reading, Penna.

HELP WANTED

BOYS Wanted. Over \$50 week! Sell name plates for front doors. Write National, 214-M Summer, Boston, Mass.

SEND For free gift offer. Sell excitingly different, taste-thrilling, Creole Candy, 2910-MP, Maurepas, New Orleans 19, Louisiana.

AGENTS WANTED

90c PROFIT Each \$1 sale! Sell real mothproofing solution. Employ agents. Experience unnecessary—we tell you how. Kinford, Wayne 3, Penna.

FREE! Big box actual full size packages foods, groceries, home needs, sent f.o.b. factory. Try them at home and show friends. World beating money making opportunity. Write Zanol, Richmond St., Dept. 6089B, Cincinnati 3, Ohio.

FARMERS! Make more money. Your own boss. Outside work. Steady year-round. 200 farm-home necessities. No experience necessary. We train and help you. For details write Rawleigh's, Dept. B-242-PPM, Freeport, Ill.

AGENTS, Distributors—Personal name plates for homes, office. Big profits. Al Peterson Associates, Box 822, Providence 1, R. I.

\$70.00 A Week extra making and selling dial tire pressure indicator for cars. Very simple and easy to make for \$1.50. Every garage and auto supply house a customer. Our manual shows how, \$1.00. Tire Pressure Indicator, Box 6126, Harlandale Station, San Antonio, Texas.

WOMEN Buy elbow pads to sew on menfolk's sweaters. Profitable agents proposition. Kann Manufacturing, Box 486 Northwestern Station, Detroit 4, Mich.

BUILD, Enjoy own local shoe business. Sell amazing, new patented Miracle Cushion shoes. Complete line, entire family. No investment, experience unnecessary. Free samples to producers. Free outfit. Paragon Shoes, 729 Columbus, Boston.

EARN Money quickly, easily, pleasantly, showing greeting cards, stationery, wrappings. No experience needed. Up to 100% profit. Send today for everyday assortment on approval. Free personal stationery folder. Thomas Terry Studios, 200 Union Avenue, Westfield, Mass.

EVERYDAY Cards. Earn \$5.00 with every ten \$1.00 assortments you sell. Also wrappings and note paper. Unusual quality. Send for samples today. Howard P. Ellis, Dept. PM-3, Pitman, N. J.

MAKE Money fast showing exquisite greeting cards—Birthday, Valentine, Easter, wrappings, notes, stationery. Full-spore time. Amazing profits, bonus. Special offers. Opportunity for organizations. Free stationery samples. Feature \$1.00 all occasion assortment on approval. Write today. Hedenkamp, Dept. F-42, 343 Broadway, New York 13.

AMAZING Offer—\$25 is yours for selling fifty \$1.00 boxes of entirely different, new deluxe all-occasion cards. Each box sells for \$1.00, your profit 50c. It costs nothing to try. Write today for samples. Cheerful Card Co., Dept. 242, White Plains, N. Y.

EASY! Fascinating! Profits to 100%. Bonus. 31 new greeting card boxes 30c up. 5c and 10c individual cards, stationery. Request free name imprinted and floral stationery samples, free 32-page catalog and \$1.00 all occasion assortment on approval. Special offers. New England Art Publishers, North Abington 79, Mass.

\$1 STARTS You in business. Sell deluxe ties, 100% wool interlining. Costs you only \$7 per dozen, you make \$5.00 dozen. Send \$1.00 for special introductory offer two deluxe ties. Catalog complete line free. Phillip's Neckwear, 20 West 22nd St., Dept. K-20, New York 10.

SILVER Cleaning, plating, polishing liquid (NuSilver). Apply with cloth. Renew silverplated ware, articles, pieces. Silverplates brass, copper, bronze. Female, male, selling representatives wanted. Part, full, time. NuProcess Products, Aurora, Illinois.

FREE Sample Nifty shirt down holder. Send dime for jobbers prices, details. Nifty, Box 812, Oakland, Calif.

MAKE Extra money handling magazine orders in your community! Build your own business. Helps furnished. Big demand. Wholesale catalog sent free! Write today. McGregor Magazine Agency, Dept. 12, Mount Morris, Illinois.

EARN Big money fast! Sell finest-quality advertising work uniforms to garages, factories, filling stations, etc. Free selling kit. Topps, Dept. PM-248, Rochester, Ind.

EARN Big money. 21 Sunshine everyday cards for \$1 with beautiful floral lined envelopes. Sensational value. Take orders galore. Costs 50c. Sells \$1. Also 1948 Sunshine notes, birthday, monogram stationery 50 for \$1. Gift wraps. Samples on approval. Write today. Sunshine Art, 115 Fulton St., Dept. PM-2, New York City.

A DRESS Yours with every 3 you order for yourself and family. Amazing new bonus plan. Everything free. Harford Frocks, Dept. J-9128, Cincinnati, Ohio.

AT Last! Something new and sensational in everyday cards. New gorgeous satin and velour designs. Get orders fast. Big profits. Imprinted stationery, 14 assortments for year 'round occasions, retail 60c to \$1. Get samples on approval. Puro Co., 2801 Locust, Dept. 840-B, St. Louis 3, Mo.

ABSOLUTELY Free! Big package actual sample fabrics and style presentation of dresses, lingerie, hosiery, etc. Take orders. Commissions big. Send no money. Melville Co., Dept. 4569, Cincinnati 3, Ohio.

CALL On friends with greeting card assortments, birthday, get-well, others. Floral stationery. Gift wrappings. Big profits. Experience unnecessary. Samples on approval. Wallace Brown, 225 Fifth Ave., Dept. B-4, New York 10.

SELL Ultra blue stock signs to stores, 1000 slogans, comedy, general, religious. 7x11, cost 6c, sells 35c. Make money. Sample free. Lowy, 8 West Broadway, Dept. 362, New York City 7.

MEDICATED Candy breath deodorant, selling to taverns, drug stores, etc. New, profitable repeater. Chex, 2910 N. 16th St., Philadelphia 32, Penna.

ECUADOREAN Native handwork brings fantastic profit. Precious sample collection \$1. Novelties immediately saleable. Moneyback guarantee. Estrella, Box 537, Quito, Ecuador.

\$3 FIRE Extinguisher; quick sales, wholesale or direct; liberal profits. "Fire-Killer," 109 N. Franklin, Syracuse 1, N. Y.

SENSATIONAL News! Our magnificent picture enlargements on lifetime plastic hardwood plaques sell on sight! Take orders for big profits. Gotham Products, Dept. A, Box 5427, Philadelphia 43, Penna.

NEW "Sponge" wall cleaner. Erases dirt like magic. Wallpaper, painted walls, ceilings. Saves redecorating. Lightning seller. Samples sent on trial. Kristee 118, Akron, Ohio.

MAGAZINE And bookmen can increase their income by selling my lawn book. 100% profit. Agents copy 50 cents. Leslie Kerr, 3825-A Tenth Street N.W., Washington 11, D. C.

AGENTS—Call on garages, filling stations with \$24.50 quality wheel balancer. Competing models to \$2,000. Virgin market. Five minute demonstration means sales. \$10 cash commission. Twenty sales possible daily. Exclusive territory. Write B & B Mfg. Co., Box 816, Sioux City, Iowa.

BIG Money selling tooth powder. Write today. James Walker, 633 Plymouth Ct., Chicago, Ill. Dept. 1.

\$2 FIRE Extinguishers. 200% profit. Sample \$1 postpaid. Lorrac Products, Albany 1, N. Y.

UNLIMITED Commissions taking orders—Colorful pocket perfume atomizers. Prospects everywhere. Dynamic Sales, Box 3552P, Cleveland 18, Ohio.

DEMONSTRATE Vanishing cigarette trick. Working sample, 25c. Schetz's, Sellersville, Penna.

QUICK Extra cash. Sell value plus greeting cards. New 1948 line. 30 boxes retailing 60c to \$1.00 each. "Flower-of-month" and initial stationery. First name imprinted remembrance notes. Profits to 100%. Extra bonus. Special offers. Write today for feature all-occasion samples on approval and free name imprinted, floral stationery sample portfolios. Elmira Greeting Card Co., M-44, Elmira, N. Y.

NEW, Fascinating novelty. Unusual sales plans. "Mad-Nets"—magnets that float, walk, jump. Attractive \$1.00 package. Details free. Frederick, Rm. 10, 4 South St., Stamford, Conn.

FLASH: "Gold finished lapel cross"; fast 35c seller. Introductory dozen \$1.00. Sell, remit 50c. Valuable sample 20c with interesting moneymaking literature free. John Walter, 39 Bath, Ballston Spa, N. Y.

WIDE Awake young men earn big money in spare time. Travel for greater profits. Tried and proven. Immediate profits, unlimited territory. Send \$1.00, no more, for amazing plan. Davidson & Company, 1377 Euclid Avenue, NE, Atlanta, Georgia.

AUTOMATIC Cigarette lighter, 98c. Electric alarm clock, \$3.69. Samples c.o.d. United Watch Company, Saint Cloud, Minnesota.

EXCITING Details, shows "how" you make big profits with our fast-selling new lines! Plastic tablecloths, aprons; personalized, cotton pillow cases, many other sales-appealing items, novelties! Write for big discount price list, "Special Deals." Hurry! Royalty, Box 748-A, Passaic, N. J.

MAKE Money at home like I do! Write immediately. Duffy (4), Covington, Ky.

SELL Sweet smelling perfume beads, earrings, combs for quick sales. Low wholesale. Mission, 2328-P West Pico, Los Angeles 6, Calif.

RAINBOW Balloons, rubber balls, cute balloon dolls, squawkers, fireworks. Merchants profit plenty. Sample gross balloons \$3.50. Ellwood Distributors, La-Junta, Colorado.

MAKE Perfume, profitable home business. Men, women write, "International," 6347 Parnell, 35, Chicago 21, Illinois.

AGENTS—Stop! Never buy plastic aprons, tablecloths, etc., until you get our new low prices. They're amazing. Riddell Sales Co., 1313-P East 62nd Street, Chicago 37.

MAKE Extra profits on each call. We tell you how with new patented 3-in-1 screw-driver. Every direct seller should carry. Write today. Johnson Equipment Co., PM-248, 1940 E. Sixth, Cleveland, O.

PAINT, White house paint, for wagon jobbers and auctioneers, 95c gallon 5's, \$1.00 gallon 1's. Minimum 50 gallons, f.o.b. Kansas City. Surplus black enamel, nationally advertised brands, acidproof, 75c gallon. Mail money order for immediate shipment. No correspondence. Trading Post, 2032 Burlington, North Kansas City, Mo.

FREE Sample! Big profit opportunity with amazing glow-in-the-dark house numbers, switch plates, pictures, decals, religious articles. Represent large manufacturer. Madison Mills, 303 Fourth Avenue, New York, N. Y.

LARGE Variety general and essential merchandise 50c to \$3 sellers. Manufacturers, 264 5th Ave., New York.

STEADY Large earnings; real staple, rubber hose; sell jobber, wholesaler, consumer, industry, automotive; no territory restrictions, no investment. Advertised line, generous, protective deal, full or part time. Ace Hose & Rubber Co., 769 Van Buren St., Chicago 7, Ill.

BE First! Get free details. Earn big money at home. Spare time. Easy, pleasant, exciting. Unlimited. 1930 Adoline, Fresno, California.

100% PROFIT. No investment, handle quality Fotostamps. Amazing glossy photographs, gummed stamp form. Business year round. Free samples, particulars, American Foto Stamp Co., 103 East 125th St., Dept. PM1, New York 35.

BIG Profit. Quick sales. Automatic adding machine sells for \$21.50. Your profit \$10.00. Write for selling plan. Allied, 2518 W. Montrose, Dept. M, Chicago 18, Ill.

STARTLING, Sensational combination fluorescent desk lamp and photo frame. Easy seller. Big profit. E.C.A., 2518 W. Montrose, Dept. M, Chicago 18, Ill.

SCHOOL Seniors: Sell classmates superb Craftcards for super profits. Write Craftcards, Box 235(AK), Pittsburgh 30, Pennsylvania.

MAKE More money selling personal initialed individualized belts, buckles, cap badges, tie holders, 2000 emblems to choose. Big profits, whole or part time. Write today special outfit offer. Hookfast Specialties, Box 1425, Dept. 6, Providence, R. I.

DISTRIBUTORS Wanted for unusual household products. Levine's, 15-X Boulevard Station, New York 59, N. Y.

FREE Water and our concentrates, makes flavors, lotions, shampoos. 72 products, labels, bottles furnished. Qualco, E-20030 Russell, Detroit.

AGENTS. Sell finest food products direct to homes. Successfully sold for 25 years. Big profits. Powerful combination sale plans make sales easy. Permanent repeat business. Samples furnished. Live territories open to distributors. Mother Hubbard Products Co., 4139 Grand, Dept. P.M., Chicago.

INFORMATION—Wholesale supply sources. Moneymaking plans. Increase your income! Write Reynard Service, Smithfield 3, Ohio.

QUICK Sure money. Selling Annie Blain favors. New Brunswick, New Jersey.

SCHOOL Seniors—Earn 40% commission selling classmates America's most beautiful graduation name cards. Largest selection. Outsell all others. Send for free sample kit. Printcraft, 1425 E. Elm St., Scranton 5, Penna.

SCHOOL Seniors! Your postal will bring our wonder, Kwick-Sell Cardalog of popular graduation name cards. Biggest profits! Only firm giving free souvenir chest and card case. Don't miss out! Hurry that postal! Craftcards, Box 235(L), Pittsburgh 30, Pennsylvania.

AGENTS—Big line including food products. Fast selling premium and bargain deals. Low prices. Send card for big outfit offer with gift. Ho-Ro-Co, 2725 Dodier, St. Louis 7, Mo.

100% PROFIT With new electric gas lighter, eliminates matches, pilot. Write Optical Research Products, Fairview, N. J.

EXCELLENT Sideline for printing and advertising salesmen. Decalomania name plates in small quantities. Great demand. Also, make money with our line of automobile initials and sign letters. Free samples. "Ralco" XL-Roxbury, Boston 19, Mass.

AGENTS: Stamping names on pocket-key protectors. Sample check with your name, address, 25c. Stamping outfits. Emblem checks, check-fobs, name plates. Hart Mfg. Co., 303 Degraw St., Brooklyn, N. Y.

MAGIC Cleaner and laundry soap deal. Hotter than a firecracker. Big profits. Sample free. Bestco, 5007 Irving Park, Chicago.

137 COMPLETE Plans for starting own business: local—mail order. Particulars free. Elite Co., 220 Grand St., New York 13.

AGENTS—300% Profit selling genuine gold window letters; stores and offices. Free samples. Metallic Letter Co., 438-B North Clark, Chicago.

GOLD Lacquered window sign letters. Large sizes penny each. New foils. Absolutely beautiful. Free samples. Atlas, 544 W. 79th, Chicago 20.

HIGH-GRADE SALESMEN

SALESMEN: Big money showing building owners sensational product; cuts essential repair cost up to 75%. Six average orders weekly pay you over \$190.00. Age: 30 or over. Get money-making facts. Write, Zone Co., Dept. B-6, Box 789, Ft. Worth 1, Texas.

START Your own business on our capital. Always your own boss. Hundreds average \$6,000 to \$25,000 annual sales year after year. We supply stocks, equipment on credit. 200 home necessities. Selling experience unnecessary to start. Wonderful opportunity to own pleasant, profitable business backed by world-wide industry. Write Rawleigh's, Dept. B-U-PPM, Freeport, Ill.

AMAZING New zipper shoe sells on sight. Big cash profits for salesmen. Leads line 200 splendid styles. Territory open. Get free sample outfit. Write Consolidated, Dept. S-47, Chippewa Falls, Wis.

SALESMEN. Earn \$100.00 weekly, selling only six pair shoes daily. Commission and bonus. Wide variety for men, women, children. No investment. Experience unnecessary. Tanners Shoes, 208, Boston, Mass.

SALESMEN. Here's a natural. New patented tool multiplies man's strength 31 times. Sell retailers. Needed by autoists, farmers, lumbermen, builders, transporters, garagemen, public works. Immediate deliveries from our U. S. plant. Write or wire for attractive proposition. Palcoseel Co., Ltd., Cornwall, Ont., Canada.

ADVERTISING Book matches—Cash in on political campaigns. Sell union label matches. Cuts for all businesses and political parties. Free powerhouse selling kit. Low prices. Protection guaranteed on repeat orders. Cash commissions. Superior Match Co., Dept. M28, 7530 Greenwood, Chicago.

MEN Wanted at once. Full or part time. Just send name, address for free copy of Specialty Salesman Magazine giving hundreds of immediate openings with reliable firms. Sales experience unnecessary as we also send free 42 page book telling how. Specialty Salesman Magazine, Dept. PM-12, 307 N. Michigan, Chicago 1.

SELL Delicious candies, nuts, gum. Immediate delivery. Write Casterline, 2031-PD Sunnyside, Chicago 25, Illinois.

BUILD Steady, large, reliable advertising specialty business. Lowest prices, largest profits on key cases, electric flasher signs, book matches and hundreds of others. Free sales portfolio. Willens and Company, 2130-R Gladys Ave., Chicago 12, Ill.

SELL Over 1100 items—Electric flasher signs, adding machines, tags, tape, all printed necessities, pencils, restaurant supplies, and many others. Free sales portfolio. No experience necessary. David Lionel Press, 312-T So. Hamilton Ave., Chicago 12, Ill.

OPERATE Wholesale candy business. Sell stores. Samples, information \$2.00. Sally Dee Candies, Newport, R. I.

SELL Calendars—Every business a prospect. Also wholesale to printers; calendars, sheet pictures. Fleming Calendar Co., 6540 Cottage Grove, Chicago 37.

FACTORY Salesmen—Sell Charles Chester nationally known cushion shoes direct. Complete line for entire family. Full time or sideline. Full time men earn up to \$20 per day in commission. Big repeats. Samples and equipment free to producers. Chas. Chester Shoe Co., 2002 Chester Bldg., Brockton, Mass.

50% TO 65% Profits. Far superior automatic fire extinguishers. Free sales kit. Freight paid. Red Ball Co., Box 1552, Salt Lake City.

ADVERTISING Book matches—World's largest direct selling manufacturer of advertising book matches offers opportunity for profitable year 'round selling; every business a prospect; no experience needed to start; men or women; full, part time; Factory service. Low prices for high quality; repeats; sales kit furnished. Match Corp. of America, 3433-43 West 48th Place, Dept. E-15, Chicago.

SALESMEN Making \$100 weekly selling automotive hardware, industrial accounts. Grimebuster mechanics waterless handcleaner. Build permanent repeat business. Write Schaffner's, Dept. PM-2, Pittsburgh 2, Penna.

SALESMEN Wanted. To sell finest quality cast aluminum ware. Write Box 337, New Washington, Ohio.

FACTORY Representatives. Hardware-electrical. Leads furnished. Farm Products Co., M-2002, Excelsior Springs, Mo.

AGGRESSIVE Salesmen. To keep stores supplied with self-selling 5c and 10c counter-card products. Nationally advertised throughout the year in leading magazines and more than 2300 newspapers. Biggest profits, full time or sideline. Write today. World's Products, Dept. 10-Z, Spencer, Ind.

POCKET Pal: Replaces pocket knives. New. Safe. Beautiful. Always razor sharp. 50c seller. 231% profit. \$15.00 or more daily. Agents, salesmen, distributors. Samples 10c. Nelson Mfg. Co., 222 W. Kellogg, St. Paul 2, Minn.

\$221.90 IN One week—Unusual? Not at all! Just look at one week's earnings of these representatives. SWB \$247.84, JRS \$252.80, HMT \$242.75, HC \$252.93, MET \$319.38, OP \$442.40. Direct mail campaign brings hot leads right into your home. Remarkable product does part of 10 men's work—a "natural" during these labor problem days. Has perfect sales story—sells year 'round. As modern as radar! Free equipment offer! We extend credit, deliver and collect. No capital required—no experience necessary. You make big profit on first sale and full credit on repeat business. Every business, store, home, factory, etc. are prospects. Write John Porter, 2433 Indiana, Dept. 304, Chicago 16, Ill.

NEW Magic menu paper, copies without carbon, used from coast to coast. Large profits for restaurant salesmen. Systematic Company, Houston 1, Texas.

LONG Needed invention. Proved success. Powerful demonstration. Every home, factory, store, office a prospect. Low price, long profit. Exclusive. Fine outfit furnished. No deposit. Get facts quick. Write 392 R. C. Building, Red Comet, Inc., Littleton, Colorado.

CASH Profit—Big earnings; selling personalized-buckles, belts, cap-badges, tie clasps, 2000 emblems, caps, shirts, ties. Write, Hook-Fast Products, Dept. A, Columbus 6, Ohio.

PHOTO-SALESMEN—Agents. Sell beautiful hand colored plastic enlargements. Collect deposit, we deliver. Profitable sideline. Send card, for free sample kit. Novel Portrait, 3343 North Ave., Chicago, Ill.

WAGON Salesmen—Fast moving carded goods and 10c line. Long profits. Free facts. Peerless, 2720 Dodier, St. Louis 7, Mo.

BIG Cash profits daily taking orders: uniforms, shirts, ties, personal initialed individualized buckles, belts, cap badges, tie holders, 2,000 emblems. Repeats. Write today. Special outfit offer. Hook-Fast Company, Box 480-PM, Roanoke, Virginia.

JOBS Open in selling! Send name, address for free copy Opportunity Magazine, listing hundreds of companies who need men now, full or spare time. Experience not essential. Opportunity, 28 E. Jackson, Dept. 17, Chicago 4, Ill.

BIG Money taking orders. Shirts, ties, Sox, pants, jackets, sweaters, shoes, uniforms, etc. Sales equipment free. Experience unnecessary. Nimrod, 4922-AN Lincoln, Chicago.

BE The Popular Mechanics representative in your neighborhood and earn big profits in your spare time. Write Popular Mechanics Magazine, Room 408, 200 E. Ontario St., Chicago 11.

EDUCATIONAL AND INSTRUCTION

LINGUAPHONE Makes languages easy. At home learn to speak Spanish, Portuguese, Italian, French, German, Russian, by quick, easy Linguaphone Conversational Method. Save time, work, money. Linguaphone correspondence courses are available to veterans under G.I. bill of rights. Send for free book. State if G.I. Linguaphone Institute, 83 RCA Bldg., New York, 20, N. Y.

WHY Don't you write? Writing short stories, articles, etc., will enable you to earn extra money. In your spare time we teach you to write the way newspaper men learn—by writing. Free "Writing Aptitude Test" tells whether you possess the fundamental qualities essential to successful writing. Veterans! This course approved for veterans training. Write today: Newspaper Institute of America, Suite 5728-B, One Park Ave., New York 16, N. Y.

1948 GOVERNMENT Jobs! Start as high as \$58.09 week. Men; women. Vets get preference. Prepare now for next examinations. Particulars free. Write today. Franklin Institute, Dept. 724, Rochester 4, N. Y.

SUCCESSFUL Men are good at figures. Add, divide, subtract, multiply easily and with lightning-like rapidity—and always be right! Make your associates envious; astound your boss. Increase your efficiency. Become a "quick-at-figures" top-flight executive. Write for free literature: Adograf, P-1209 South Garfield Ave., Alhambra, California.

STAMMERING Corrected. Booklet gives full information. Write: William Dennison, 643-A Jarvis St., Toronto, Ont.

NOW You can have an office. Learn credit-collection business by new home study course. Many earn up to \$5000-\$15,000 annually. Free bulletin. Franklin Credit School, Dept. 202B, Roanoke 7, Va.

MAKE Up to \$30-\$40 week as a trained practical nurse! Learn quickly at home. Booklet free. Chicago School of Nursing, Dept. M-2, Chicago.

JOIN The Salesman's Club. Training—placement. Box 1805, Portland 11, Oregon.

DEPEND Yourself masterfully. Use amazing secret guerrilla tricks of self-defense. Easy, sure, effective. Free literature. Inspiration House, 3108 Hillside Road, Harrisburg, Penna.

WANTED. International and other good used correspondence courses and books. Write for catalogue and quotations. Baker, 5509 B Winthrop, Chicago 40.

ANALYZE Handwriting for profit! Complete outfit \$1.00. 4462-R Germantown, Philadelphia.

BOOKKEEPERS! Increase your earnings! Operate your own simplified "Dollar-A-Week" bookkeeping and tax service. Full or spare time. Details free. No obligation. Ellis, Box 207-F, Cedar Grove, North Carolina.

WELDING—Electric, gas trade training pays at GI approved welding school. Catalog free. Write Hobart Welding School, Box M-285, Troy, Ohio.

LEARN Air conditioning at home. Big demand for trained men. Enormous profit opportunities. Write Nelson, Box 8-C, Warner Robins, Ga.

WAKE Up! Investigate your overlooked resources—unsuspected opportunities. New home study course solves mental worries, develops confidence, increases income. Details free (expect something revolutionary). Jay Dalton, Psychologist, Box 824, Los Angeles 53.

FOOT Correction! Extension. Degree. National School of Foot Correction, Juneau 1, Alaska.

3800 CORRESPONDENCE Courses cat. 50c personal course barbells. EG, Elmsford, N. Y.

STUDY And win. Send \$2 for your copy. John V. Jewett, 19 Craftsland Road, Chestnut Hill 67, Mass.

AMAZE With Supermemory. Step up your brains and income. Get facts free. Write CM2, Thor Books, Box 1210, Chicago

INVESTIGATOR Training. Phillips Secret Service, 1917B North Kenneth, Chicago 39, Illinois.

NEW Writers needed. Want to cash editors' checks? If you can read, we can teach you how to write for pay. Earn as you learn. First lesson free on request. No obligation. Send postcard today. Comfort Writer's Service, 200 S. 7th St., Dept. 11, St. Louis 2, Mo.

EXPERT Bookkeeping, easily learned. 15 lesson course \$5, introductory lesson 35c. Bernard Buchalter, 1280 Ocean Ave., Brooklyn 30, N. Y.

LEARN Photo-engraving at home or in oldest, largest school in America. Work for newspaper or establish own profitable business. New Tasope' Photo-Engraving equipment available soon. Write for information. Veterans ask about G.I. training. The Aurora School of Photo-Engraving, Tasope' Bldg., Aurora, Mo.

BECOME Sanitation supervisor. Seven easy lessons. Certificate, profits, promotion. Institute, 2385-A Edgewater, Los Angeles 26.

HOME Study course, drugless therapy. Free literature. Institute of Drugless Therapy, Tama, Iowa.

MEDICAL Laboratory technicians in great demand. We train you in your spare time, in your own home. You can practice while studying. Write for free catalogue. Imperial Technical Institute, Box 973-E, Austin, Texas.

USED Educational books on all subjects sold, rented, also bought and exchanged. Moneyback guarantee. Write today for free catalog and details. Lee Mountain, Pisgah, Alabama.

SECRET Investigation. Experience unnecessary. Investigators particulars free. George Wagner, M 125 West 86th, New York.

PLAYS, STORIES, MANUSCRIPTS

PROFITABLE Book publication on even the limited sale of your book is possible. Details in our free copy of "A Decade of Publishing." Dept. K, Exposition Press, One Spruce Street, New York 7, N. Y.

I WANT New writers to cash hundreds of checks for \$1 to \$100, offered each month. The easiest way to write for pay. No previous experience necessary. Send for free details. No obligation. Saunders M. Cummings, 467-M Independence Bldg., Colorado Springs, Colo.

EVERY Help for all writers. Low cost. National Writers Club, 1837 Champa, Denver 2, Colo.

BUSINESS SERVICE

SWITZERLAND; Watches, anything. Factory prices. Catalog free. Post Sach 954, Solothurn, Switzerland.

SPECIAL SERVICES

SPEECHES Written for all occasions. Smith, 5635 Nicollet, Minneapolis, Minn.

FORWARDING. Prompt service, letter 25c, monthly \$2.00. Also special services performed. Arlestors, Box 256, New York 30, N. Y.

POSTMARK Your mail. "Washington, D. C.!" Letters mailed here, 25c each. Complete (receiving, re-forwarding) service, \$3.00 monthly. "Hawkins," 1300 Taylor-k N. W.

IF You have a new product to market, use my Sales Promotion Plan to make big money. Details free. Wellington J. Smith, Direct Advertising Service, 9611 Clifton Blvd., Cleveland 2, Ohio.

MANUFACTURERS Increase your markets! Find new uses for your present products, new products and waste products. Chemical, biological, electrical, mechanical and textiles. Sample or description with all technical information available with check for \$1.00 will bring you an appraisal by experts. Applications Research, Newtown, Penna.

MFG.—Wholesale sources. Most any item. "Service," 1332 D Findlay, New York City 56.

MAIL Forwarded from New York. 10c letter. United, 118 Lincoln Avenue, Brooklyn 8.

LETTERS Remailed 25c, three 50c. H. N. Johnson, Desk B, Box 85, Jacksonville 1, Fla.

CARTOONING, COMMERCIAL ART, SHOWCARD WRITING, SIGN PAINTING

FAMOUS \$75 Lockwood art course now only \$5 postpaid. Other smashing art bargains. Catalog 10c. Art Book Shop, Arnold 5, Mo.

LEARN Showcard writing at home in spare time. Fascinating, profitable. Free information. Sherwood Publishing Co., Irvington, 11-Z, N. J.

"HOW To Make Money With Simple Cartoons"—a book everyone who likes to draw should have. It is free; no obligation. Simply address Cartoonists' Exchange, Dept. 92C, Pleasant Hill, Ohio.

TEST Free to prospective art students. American, Box 8066, Dallas 5, Texas.

OPTICAL Illusion! Makes drawing simple tracing. Bruce Enterprises, North Hollywood 2, Calif.

LEARN Cardwriting. Free details. O'Rourke, 1534 W. Valley, Alhambra, California.

MAKE Up to \$100 weekly cartooning, illustrating, designing and lettering at home. No experience necessary. Big, new, simplified method shows you how. Rush name for free trial offer. National Artists Bureau, Box 4248-M, Dallas 8, Texas.

9 ALPHABET 3 Numeral pattern sets and catalog, \$1.00. Sign Letter Distributors, P.O. Box 101, Mineola, N. Y.

DRAWING Stands direct from factory. Send for circular. Sutter-Craft, Dept. S12, Eau Claire, Wis.

SIGN Painting taught at home by an old master. Ben Kerns, Box 812, Greenville, S. C.

CHALK Talks. Laugh producing program, \$1.00. Catalog 10c. Balda The Cartoonist, Oshkosh, Wisconsin.

ADVERTISING AGENCIES, LETTER WRITERS, FOR ADVERTISERS

FREE! 1948 Advertisers Rate and Data Directory, 52 pages! E. H. Brown Advertising Agency, 20 N. Wacker, Chicago 6.

INCH Display advertisement Mailorder World, year \$24. Wood's Services, Atlantic City, New Jersey.

MAILING List, 1000 names, wealthy resort prospects, \$10.00 cash. BMA Co., 5027 Sunderland, Jacksonville, Fla.

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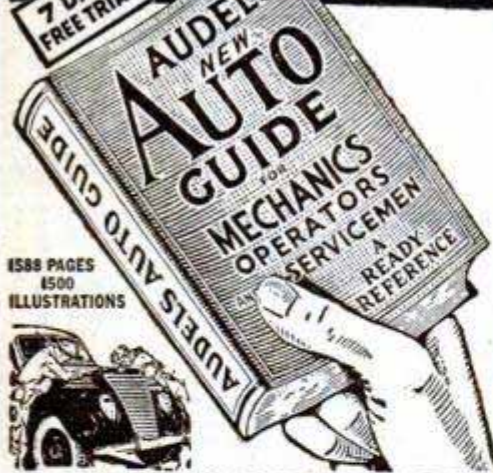
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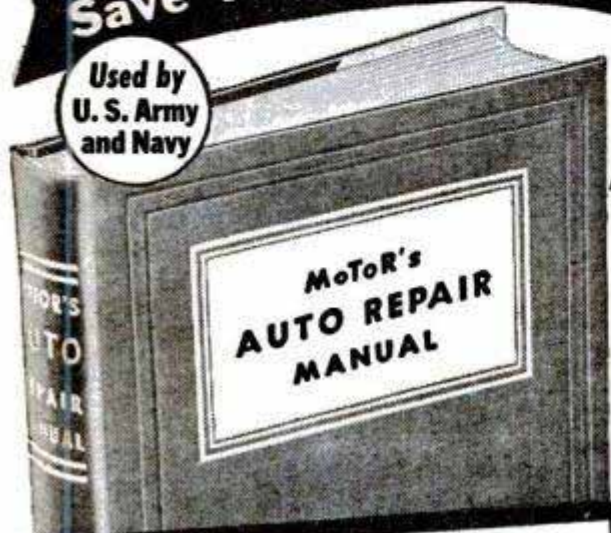
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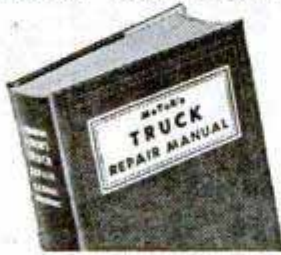
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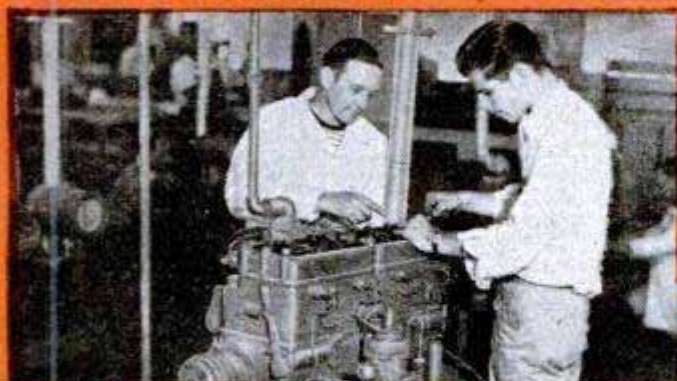
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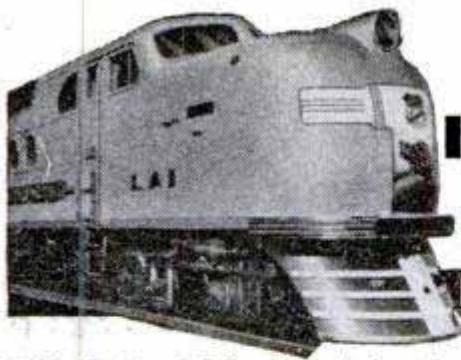
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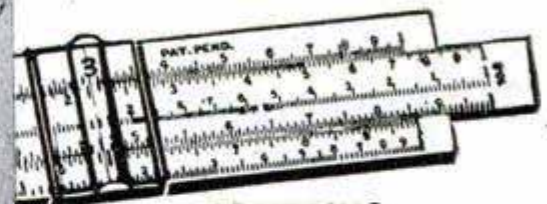
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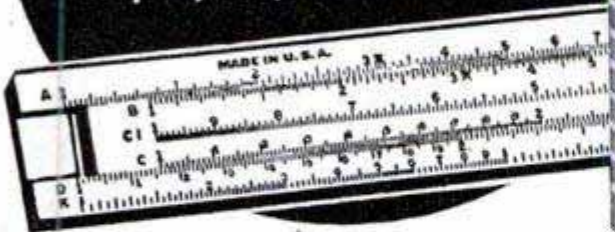
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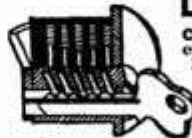


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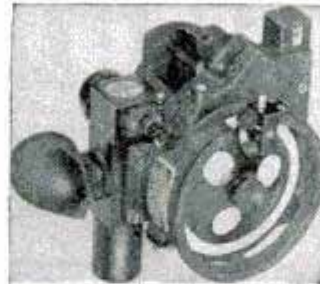
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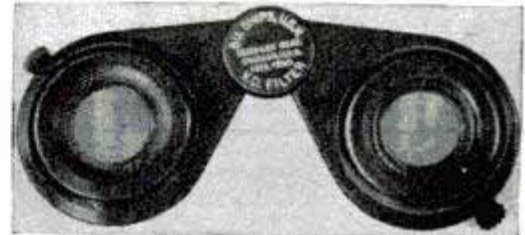
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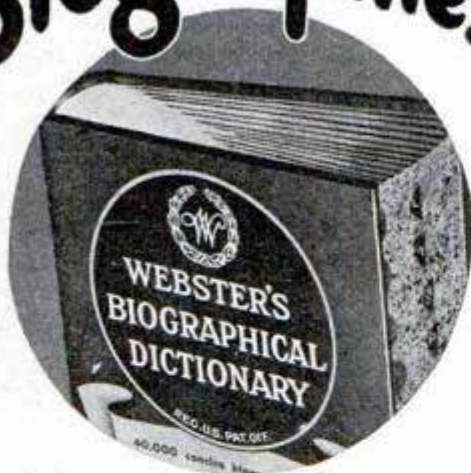
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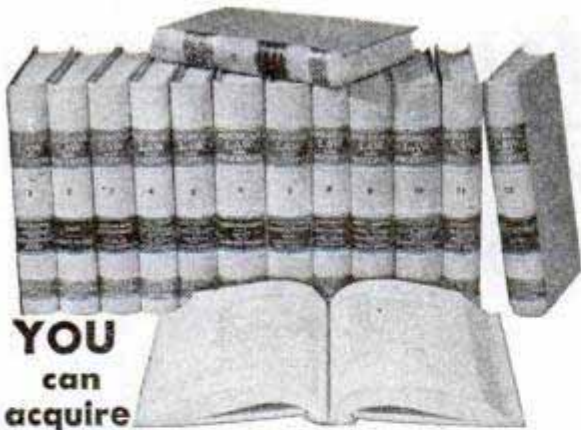


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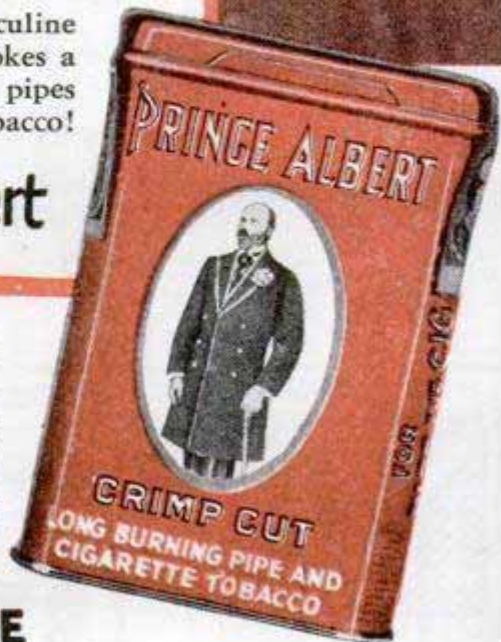
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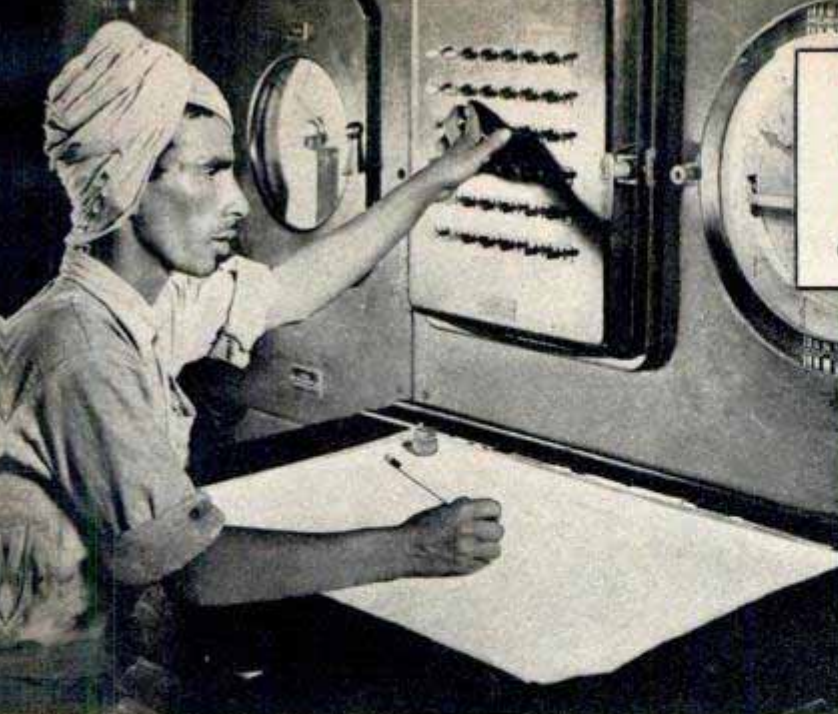


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FEBRUARY
1948

WRITTEN SO YOU CAN UNDERSTAND IT
VOL. 89 NO. 2

Under the sands of Arabia lies the greatest oil pool known, and its development by a partnership of an Arab king and American businessmen has changed the life of the nomads

INDUSTRIAL REVOLUTION in the DESERT

A UNIQUE partnership between a past and a present civilization has been functioning in the desert country of Saudi Arabia and the end result may be of great moment to the economy of the world.

For eddying slowly beneath the 800,000 square miles of shifting sands of that sub-continent are proven reserves of approximately 6,000,000,000 barrels of oil. And oil, unless a developing atomic age changes the nature of all things, is the blood of 20th century economic life, either in peacetime or in wartime.

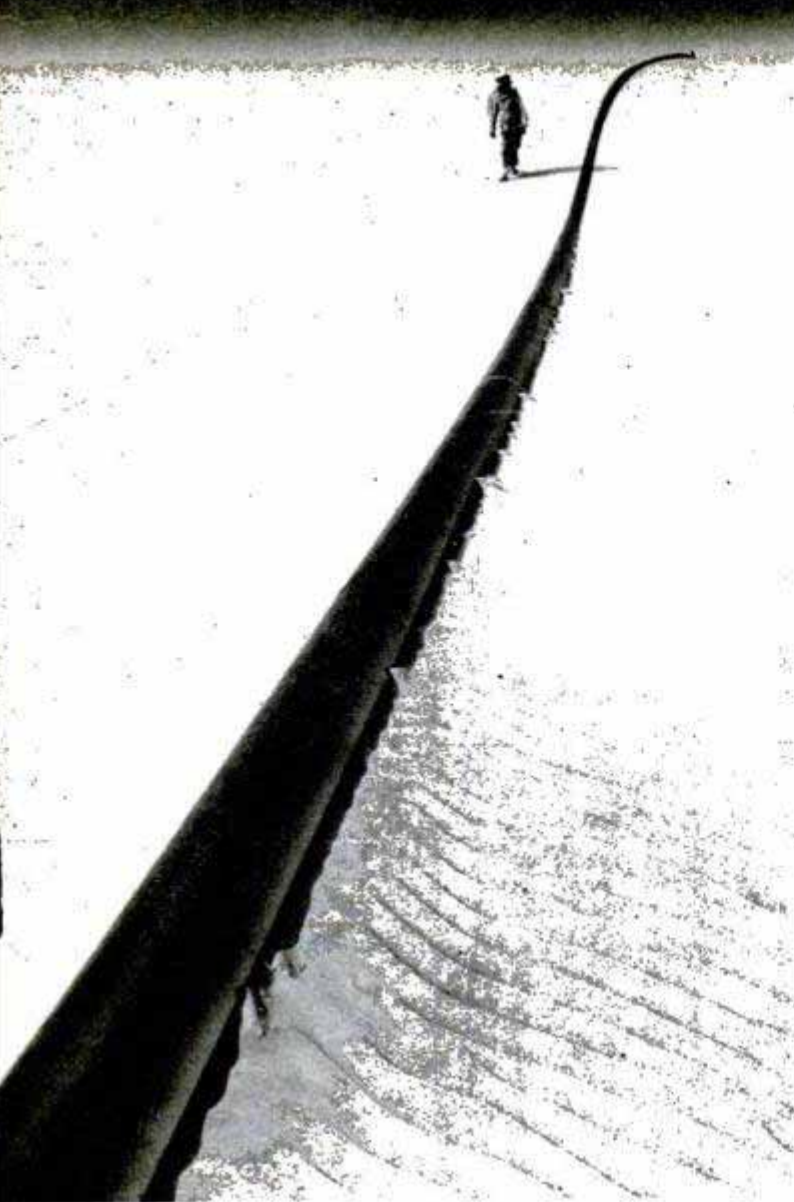
By John C. Henry

Actually, the proven figure of 6,000,000,000 barrels is merely the beginning as reflected in preliminary tests and production in hardly more than 20 percent of a 450,000-square-mile concession held by American interests. Oil geologists are virtually unanimous in considering the Saudi Arabia area as the greatest known petroleum deposit in the world.

Geologists jointly representing two American concerns, Standard Oil of California and the Texas Company, in the early 1930s established the existence of

Mirage? Far from it! The Ras Tanura refinery in Saudi Arabia produces 2,000,000 gallons of gasoline daily



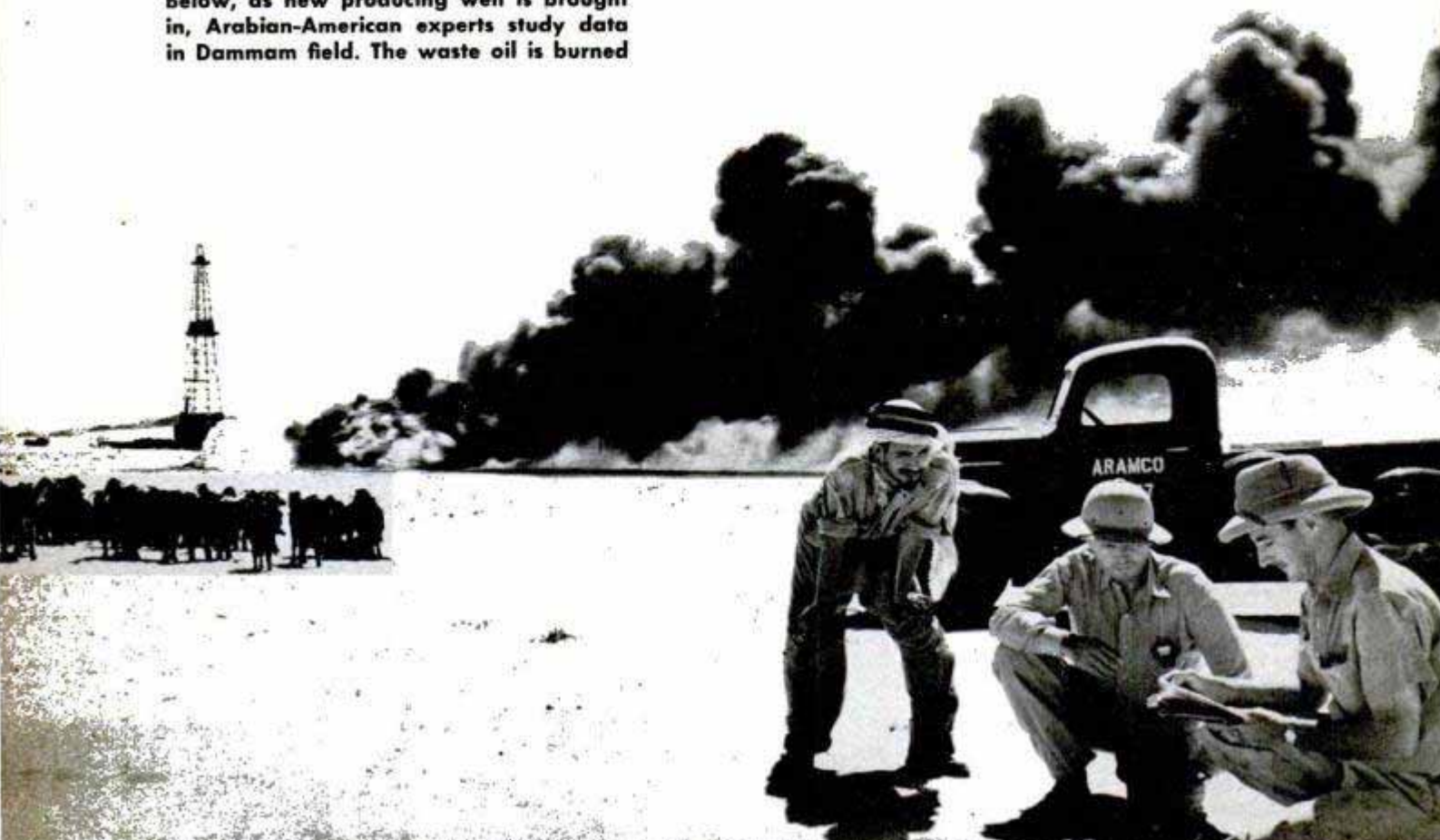


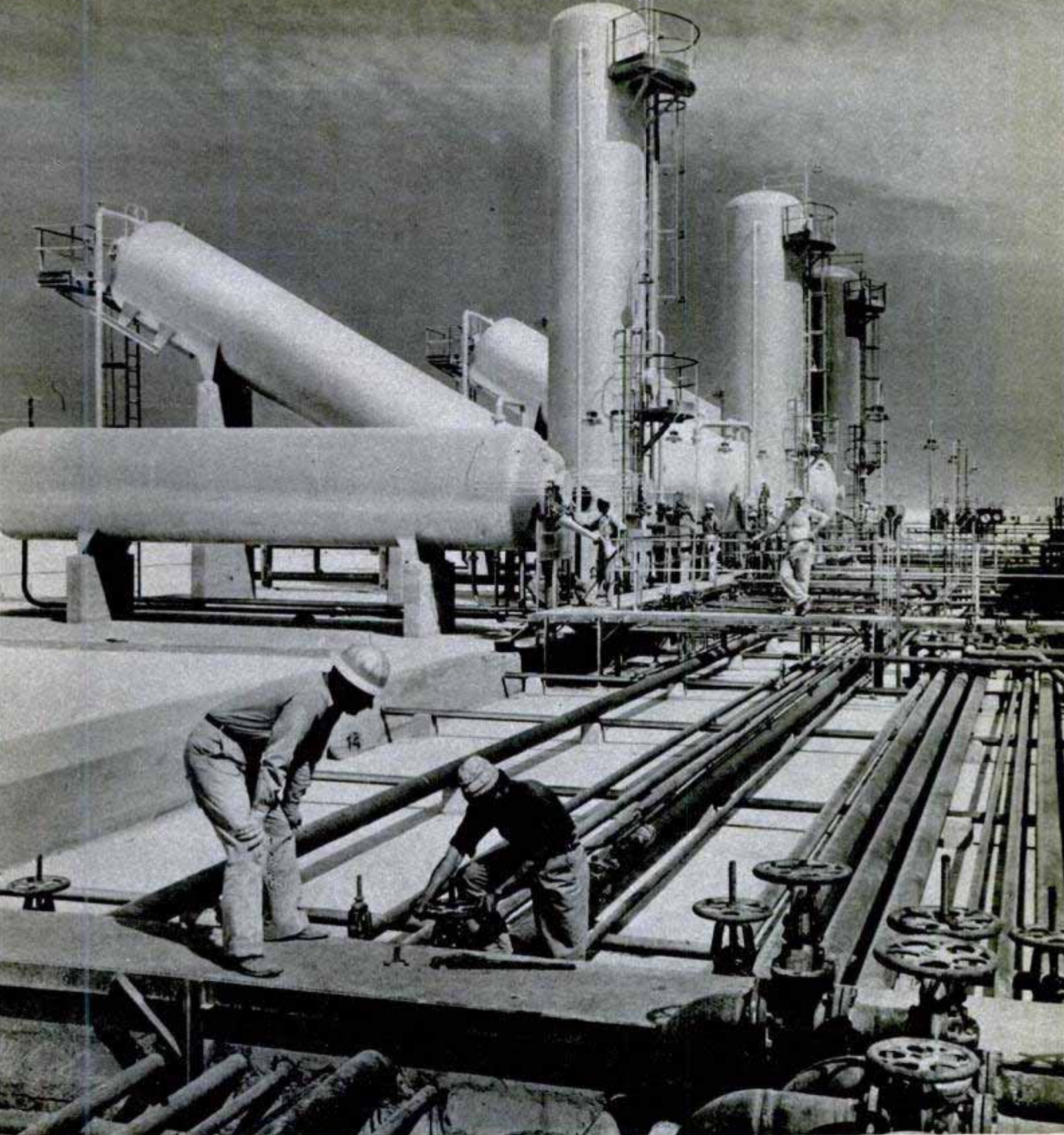
A strange traveler on the desert sands is an Arab patrolling the oil pipe line. Below, as new producing well is brought in, Arabian-American experts study data in Dammam field. The waste oil is burned

petroleum deposits on Bahrein Island, about halfway down the Persian Gulf. The discovery made almost certain the probability that similar oil-bearing structures would be found in the Arabian mainland and the stage was set for a high-stake game of international bidding. British, German, French, Italian and Japanese interests all prepared to enter—as did representatives of the two American companies.

Holding the prize was Abdul Aziz ibn Saud, desert chieftain who had won his kingdom by force of arms and who was already wise in the ways of foreign imperialism. A strict Moslem who viewed western ways of life with some distrust, he recognized in all bidders, other than the Americans, actual or potential instrumentalities of foreign governments ready to intervene in the affairs of the Arabian peninsula. The American bid represented private enterprise, technically skilled and separate from this government and, as such, representing no threat of interference in the politics of Arabia. On this basis he made his choice in 1933 and the result has been an Arab-American partnership of great mutual benefit. What effect the rising temper of the Arab world over the partition of Palestine will have on this partnership is a matter of immediate moment.

To the American personnel undertaking the Arabian development, the locale was a new frontier. Problems of climate, of communications, transportation, equipment and manpower were matched by the delicate intangible of establishing and maintaining good relations with a people and a





This is the treating plant at the Arabian-American Oil Company's Ras Tanura refinery along the Persian Gulf; here a major portion of Arabia's oil output is brought by desert and submarine pipe lines from three fields

government who were basically wary of Christian westerners. The development, both economically and sociologically, has been an interesting saga in pioneering—one which brought profit both to the oil interests and the Arab government and which someday might be even more vital to American public interest if ever again we are faced with a war of survival.

First of all, the Arabian-American Oil

Company recognized the obvious fact that water supply is a basic concern in Arabia as in any desert country. Company geologists determined that there were water tables not only in the neighborhood of the scattered natural oases, but under much of the rest of the country. Accordingly, at each experimental oil drilling and at many other strategically located points artesian wells were drilled, some of them going to




The water hole above is one of the few natural sources of fresh water in Saudi Arabia. The Arabian-American Oil Company started a large irrigation project using water from this source

800 feet before reaching a water source.

At Ibn Saud's capital city of Riyadh an entire system of wells was planned and drilled. Near Jidda, Red Sea city where the foreign missions are located, a company survey located a water table about 25 miles distant and a Saudi-government contract financed by oil royalties was let to a British engineering firm for installing the supply system, first of its kind in a city that previously had depended upon distribution of its water in drums.

Inland transportation likewise was an obvious necessity not only for the oil op-

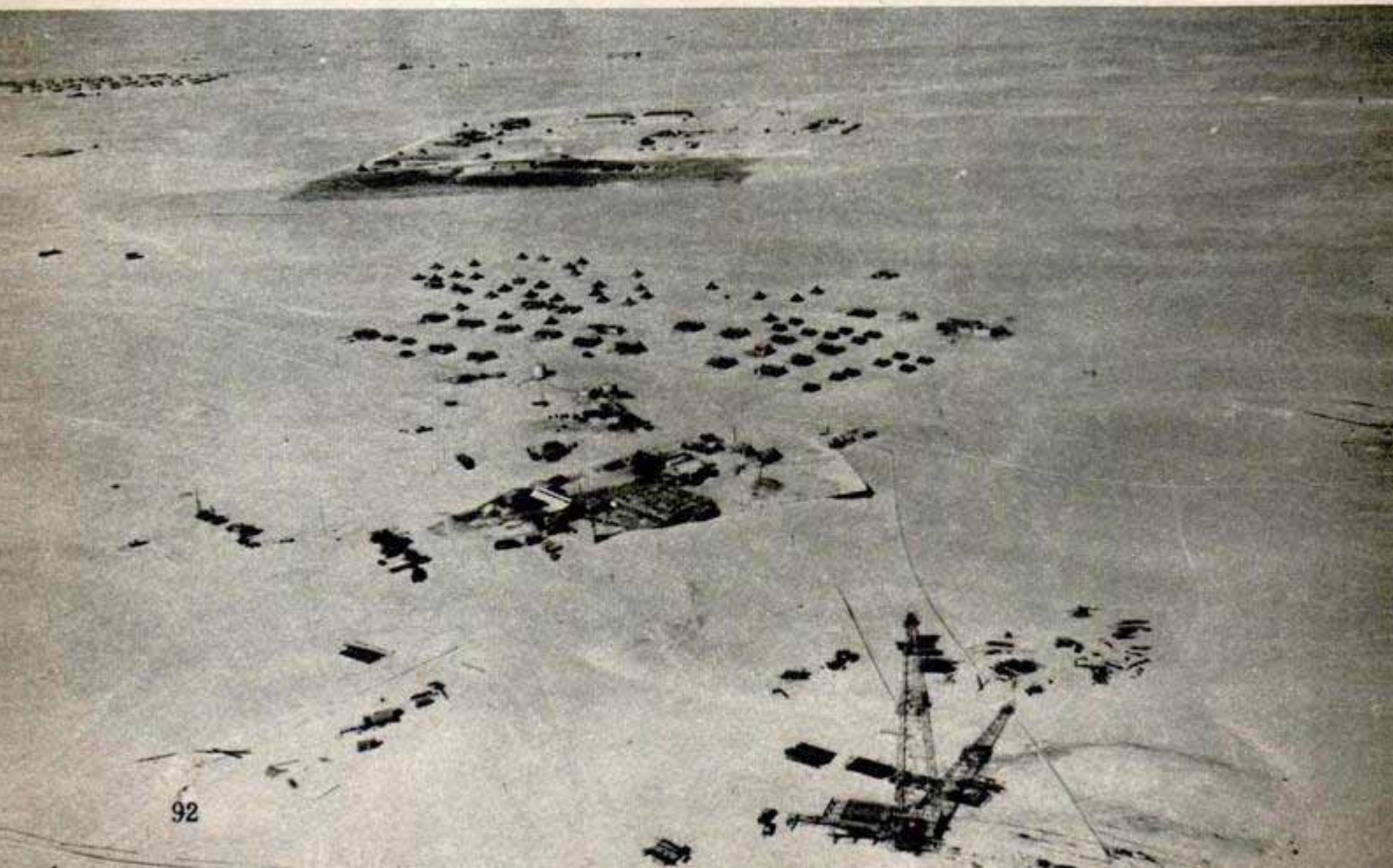


erators but for modern development of the country. Except for a few unconnected highways on the Red Sea coast and even fewer along portions of the Persian Gulf shore, shifting desert trails followed by camel caravans constituted the only trans-Arabian links. The single-track Hejaz railroad connecting Damascus with the Holy City of Mecca, was destroyed by T. E. Lawrence and his followers during World War I.

As one of its initial projects, Aramco put American surveyors on the task of mapping the terrain for fixing the trails. As far as possible the yearly sand drift was plotted. Some dunes were found to move as much as 40 feet in a year and some rose almost 100 feet in height. A mixture of sand and bitumen was tested and the most effective formula determined for light and relatively inexpensive surfacing. Cars were fitted with oversize tires, extra flanges on the fenders as sand guards and heavier-than-ordinary transmissions.

Greatest stride in Arab transportation began during the war, however, when

Twenty-five wells are pumping 200,000 barrels of oil every day from a depth of 7000 feet under Abqaiq field





American planes made occasional stops at Dhahran, Persian Gulf headquarters town for Aramco. Several special missions even went into Riyadh by air, an improvised airfield being marked off on the desert with oily black lines and smudge pots. These first air "invasions" of the country required special diplomatic arranging but the king and his government were not slow to recognize the advantages of air travel over such terrain.

When American military strength began to flow from the European to the Asiatic theater an agreement was reached between the two governments for construction of a modern airfield at Dhahran. U. S. Army Air Engineers completed the job in March 1946, and by agreement the U. S. Air Forces will continue operation of the port until March 1949. Today, the field has two concrete runways, 6000 and 7000 feet; an operations and control building, hangars and other equipment.

The Saudi government financed an airline of its own, acquired a fleet of surplus DC-3 planes, leased its operation to Transworld Airlines and now runs a scheduled service connecting Jidda, Dhahran and several other Arabian points with Cairo, Baghdad, Basra and other key Middle-East cities. Aramco operates a fleet of more than 20 company planes in and out of Dhahran, Transworld makes Dhahran a regular stop on its U. S.-India service and BOAC (British) and KLM (Dutch) make fuel stops there. Dhahran traffic passed 400 aircraft per month in September 1947.

Three major railroad projects were approved and one is under construction. This first one will connect Dammam, Persian Gulf port site, with Riyadh by way of Abqaiq, center of one of the great oil fields. Aramco engineers made initial studies on this project, also, and the company

(Continued to page 264)

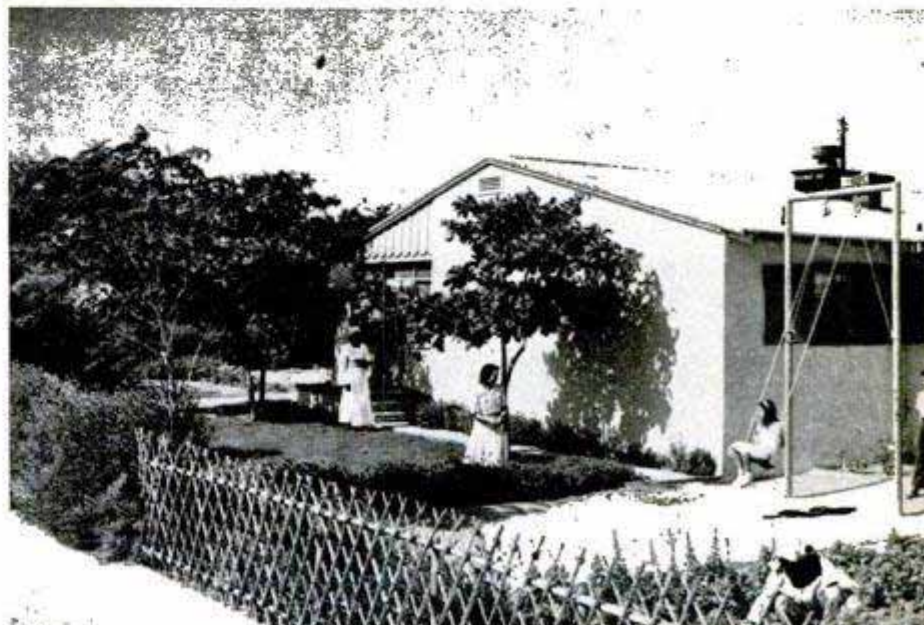
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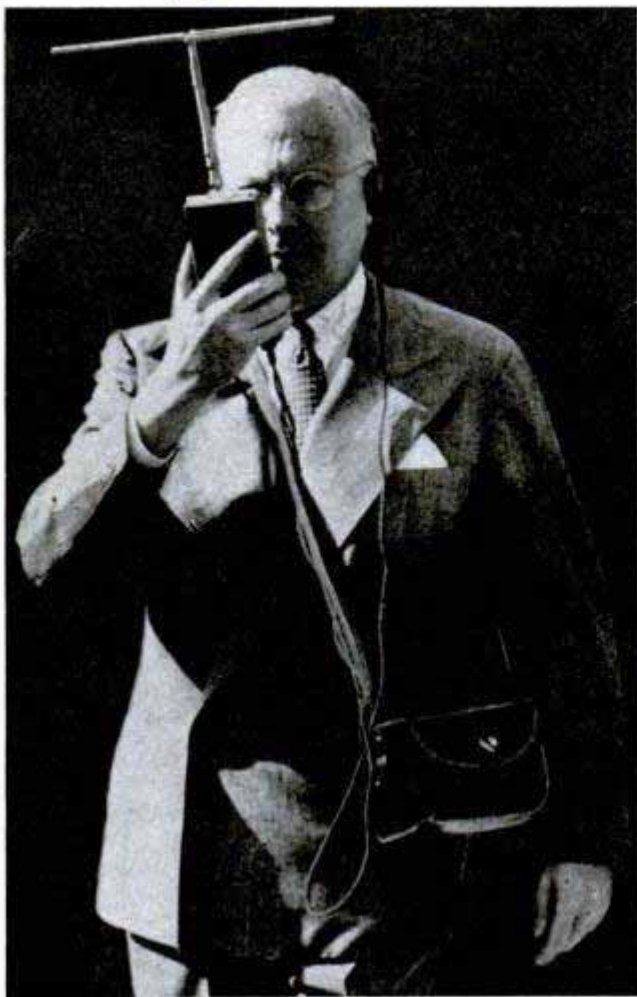


Drinking fountain for camels at El Hani, way station on desert road in Saudi Arabia, was provided by oil company which drilled the well. Hundreds of camel caravans and Bedouins stop here



Through these pipe lines pass millions of barrels of refined products from Ras Tanura refinery to marine terminal on the Persian Gulf coast. Below, a typical bungalow in Dhahran for American oil workers brings a bit of the U. S. A. to Saudi Arabia





Walkie-Talkie Weighing 11 Ounces For Workers and Sportsmen

Workers and sportsmen who are normally far from ordinary kinds of communication can use a walkie-talkie that weighs only 11 ounces. Developed by a Cleveland firm, it is six inches long, about three inches wide and will be tuned to frequencies in the 460-470 megacycle range.

Swing Saw Has Depth Adjustment

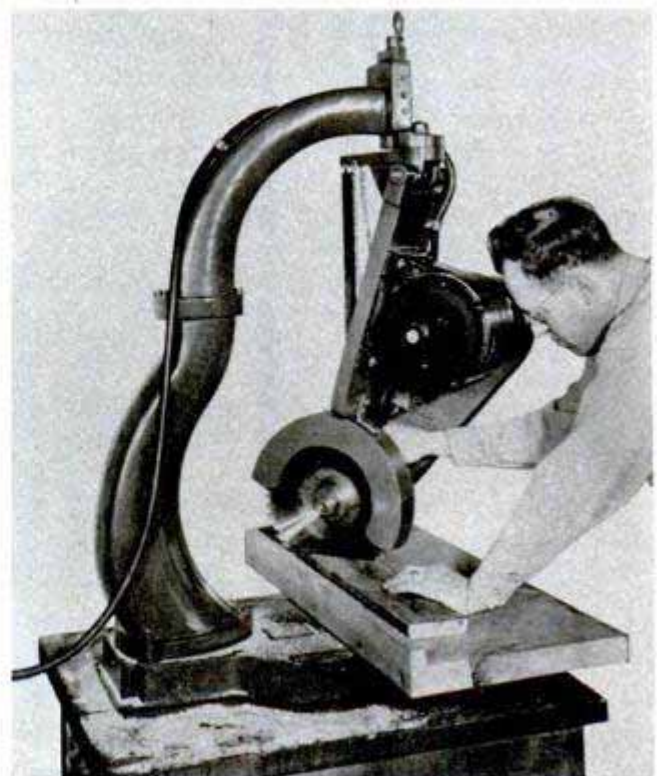
Supported by a strong gooseneck column, a counterbalanced swing saw can be moved from job to job without difficulty. A swivel adjustment on the swinging arm permits miter cuts up to 90 degrees right or left. The saw, powered by any standard $\frac{3}{4}$ to 2-horsepower motor, cuts material up to 14 inches wide and can be adjusted for cuts up to 3 inches deep. The complete unit weighs only 330 pounds.

Many of the new products described in this issue of Popular Mechanics are either already available or are soon to be marketed. For additional information concerning these products, including the names and addresses of manufacturers or distributors, write to the Bureau of Information, Popular Mechanics Magazine, 200 E. Ontario St., Chicago 11, Ill. You will be answered promptly



Plastic Gas Pipes

Plastic tubing is replacing steel pipe in carrying fuel gas from the main to homes. The one-inch Tenite tubing is lightweight, easily handled, can be bent on the job, requires little equipment for joining and resists deterioration in most soils. Only those soils containing products of oil refining affect the tubing. Joints are made by coating the two ends with a solvent cement and slipping a slightly larger pipe over the splice. The cement "welds" almost instantly and is colored to permit visual inspection of the joint. Gradual bends can be made in the flexible tubing and right-angle bends are formed with prefabricated right-angle sections. The pipes withstand a maximum safety pressure of 30 pounds per square inch. Gas-tight fittings permit joining the tube to steel or copper pipe.



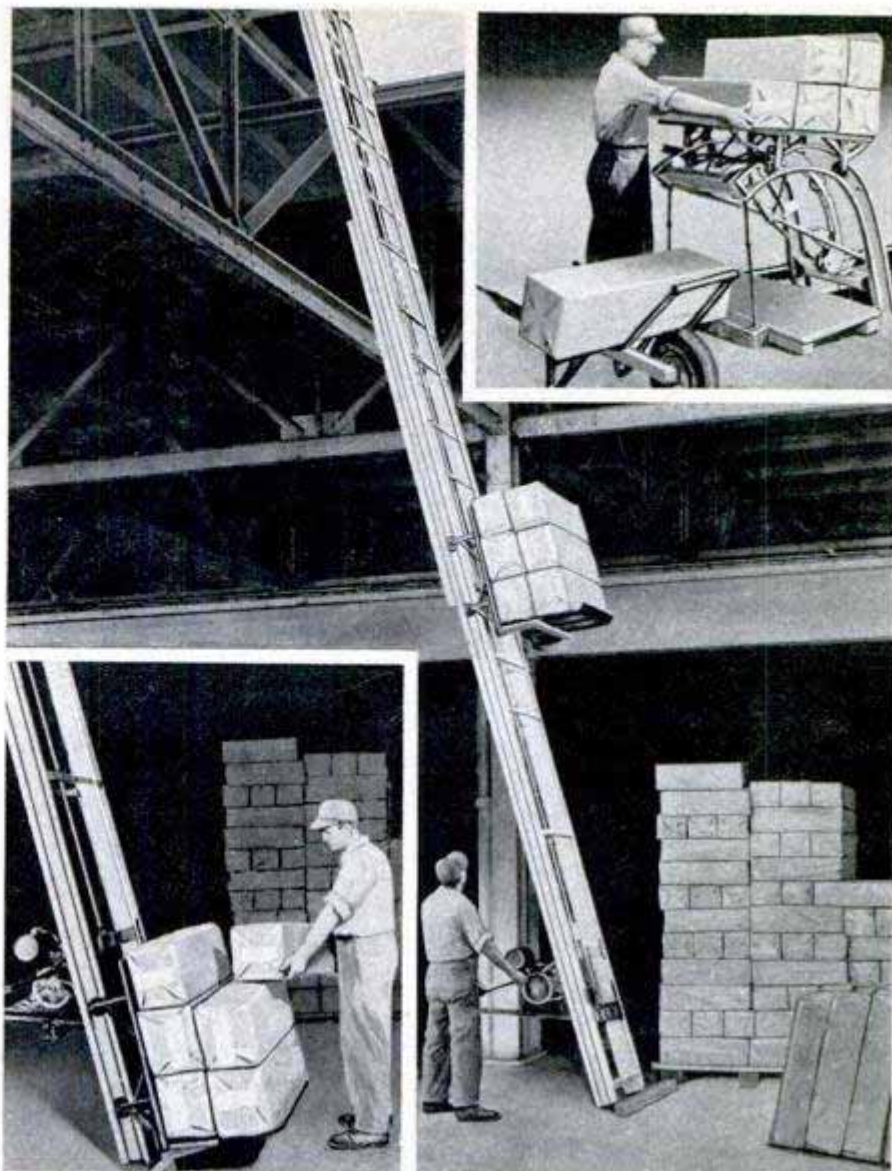
Ladder-Like Hoist Lifts 500 Pounds

Heavy materials climb a ladder by themselves when a power hoist that looks like an extension ladder is used. Made of aluminum, the hoist has two tracks in which the four wheels of the loading platform run. At the top, the tracks are curved for easy unloading of the material. Portable, the hoist can be assembled and taken down quickly and handles up to 500 pounds at a speed of 80 feet a minute. A small gasoline or electric motor provides the power. Movement of the platform is controlled by an operator at the base of the ladder.

Radioactive Gold Aids Cancer War

Radioactive gold is being used experimentally to treat cancer and leukemia patients. Results in treating chronic cases of leukemia have been as good if not better than with X-rays, according to Dr. Paul F. Hahn, associate professor of biochemistry at the Vanderbilt School of Medicine. Gold is made radioactive by the chain-reacting uranium pile at Oak Ridge, Tenn., which created the atom bomb. In treating leukemia, the radioactive gold is

injected into a patient's vein. In the case of a tumor or cancer, it is injected into the tissues to infiltrate the tumor with radioactive material. The treatments, which eliminate many of the undesirable features of radium, cost about \$5 each.



Midget Crawl-Type Tractor Has Engine in Rear

Designed for small farms, a small tractor has tracks instead of rear wheels and an engine mounted in the rear. The tractor's frame is made of welded steel and the tracks of fabric and rubber. The six-horsepower air-cooled engine delivers enough power to pull a 10-inch plow. The track mounting and the front axle permit 20-inch clearance for cultivating growing crops. Built into the frame is a power take-off for converting the tractor into a stationary power plant. The tractor has a reverse gear, travels 2 $\frac{3}{4}$ m.p.h. and operates four hours on a gallon of gas.



PACIFIC SWEET SPOT

By J. R. Farrington
Delegate to Congress from Hawaii

Hawaii, which soon may be the 49th state, pours a pipe line of sugar and pineapples to America from its highly mechanized plantations



Above, boom sprayer used in pineapple fields against mealybug, which once nearly wiped out the industry. Below, machine grading pineapples according to size

MAGIC CARPETS that move boxcar loads of sugar cane over ground in which even wheelbarrows become mired, and conveyor belts that whisk pineapples from the field to collecting bins are among the newest innovations to appear in Hawaii's sugar-cane and pineapple fields.

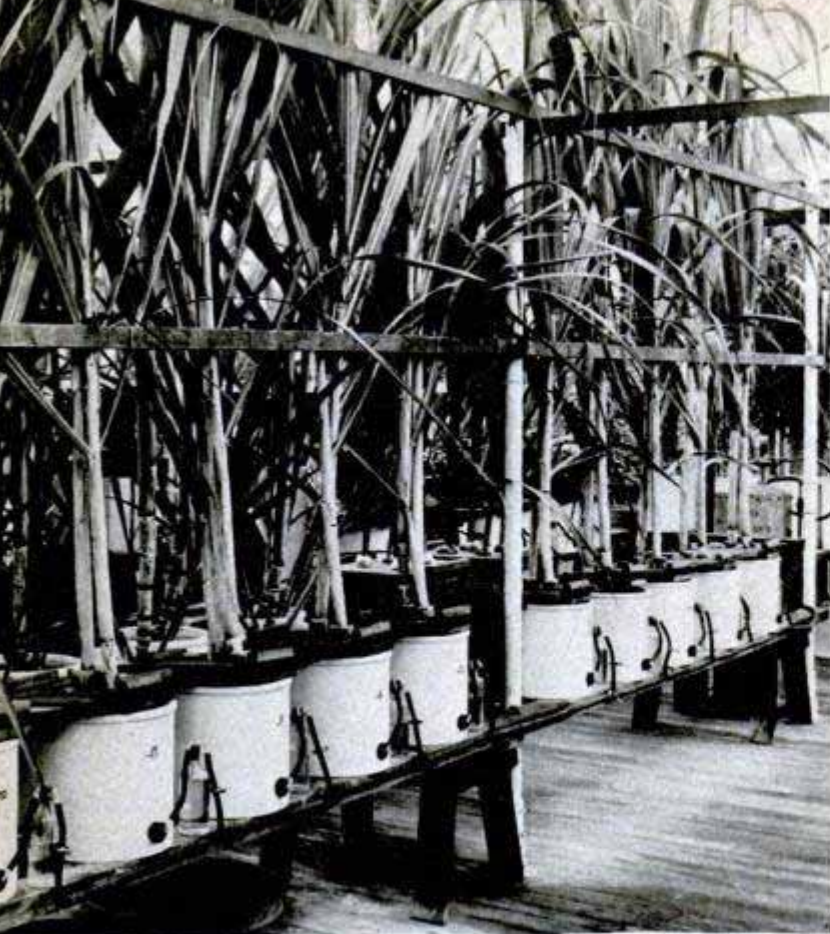
But they are just two of the countless machines and techniques the territory's two leading industries are developing to meet the competition from areas whose markets are closer and production costs are lower. Hawaii is the most remote of the world's important land areas. Her plantation employees are the world's best paid on a year-round basis.

The ultimate aim is to make all field operations completely mechanical, or as mechanical as complex farming jobs such as these can be.

In the canneries, ingenious machines known as Ginacas grasp the fruit, slice off the outer shell and remove the core, all in one operation, and deliver them at the rate of 100 a minute. It was this machine, invented by a Hawaiian, Henry Ginaca, in 1913, that made large-scale pineapple canning possible and helped make Hawaii the source of 90 percent of the world's supply.

Movement of cane through the sugar mill is a production-line operation. The stalks are fed in on an endless belt. Water, shot from sprays under great pressure, rips





Breeding pest and disease-resistant sugar cane is a major goal at the planters' experiment station

off dirt and debris as the belt moves. Huge rollers and crushers squeeze and resqueeze the stalks until they resemble straw. After a complex settling and filtering process, the juice goes to a series of evaporators, boilers and vacuum pans which converts it into a sort of crude molasses. Whirling centrifuges convert it into raw sugar, ready for shipment to the mainland refinery.

It's a big job to bring techniques such

as these to the field, but important strides have already been taken and the future seems bright.

The magic carpet is only one step, and a relatively minor one, but it illustrates how some of the problems are being overcome.

Where rainfall is exceptionally heavy, moving the cane from the field to the industrial road by conventional means of transportation constituted an almost insurmountable problem. The lightest trucks often became hopelessly bogged down.

Plantation technicians finally hit upon the idea of applying the sled principle to the job, and the result was the magic carpet. It is a huge rubber mat which is dragged across the slick field by cables, hauling up to three tons of cane in one load.

Transporting cane to the mill is another problem. Almost every conceivable method is used, including flumes, overhead trolleys, railways and giant trucks built specially for the task. Uniformity is impossible because of Hawaii's varied terrain, ranging from snow-capped volcanic mountains to semiarid wasteland.

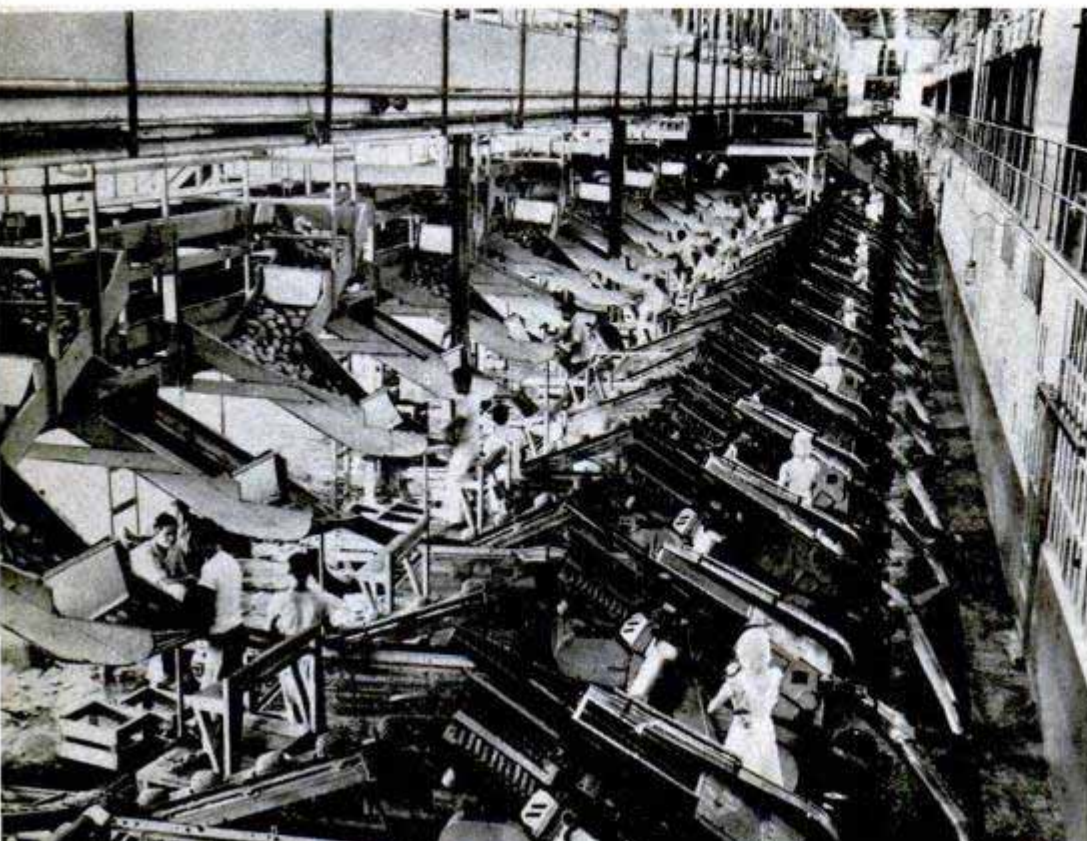
Most spectacular and costly of these methods is the flume—a wooden trough similar to those seen at logging camps—through which the cane is floated to the mill. Some stretch 50 miles or more—along ditches, at shoulder level across fields, and high in the air on spidery trestles over gorges and ravines.

Until quite recently, the most widely used transportation was the narrow-gauge railway. Most plantations have their own systems, ranging from a couple of miles of track and a few cars and engines to 100 miles of rail and more than 1000 pieces of rolling stock. During harvesting, portable track is run from the main line to the fields.

Introduction of more efficient motorized equipment, much of it developed by the plantations themselves, has cut down rail traffic. A recent survey showed 10 of 33 plantations use motorized equipment exclusively.

Some of these motorized giants are so large that their wheels would straddle even the widest highways. One plantation uses a model that carries up to 50 tons of cane.

Irrigation is another headache. Its magnitude



Ginaca machines that shell and remove core of 100 pineapples a minute started a big industry

can be appreciated by the fact that it takes one ton of water to produce a pound of sugar.

Several methods are used, most common of which is the irrigation "ditch." There are two on the island of Maui, one delivering 40,000,000 gallons daily from the mountains to the fields, and another pours out 50,000,000 gallons a day.

The water rushes down channels dug out of the mountainside, into tunnels cut two or three miles through the volcanic rock, through huge pipes and siphons. Hundreds of pumps are constantly at work along the way to maintain the flow.

One, prosaically designated "pump #7" of the Hawaiian and Commercial Company, is said to be the biggest and most powerful of its kind in the world.

Some plantations developed their own systems to meet special needs. One has a portable "ditch," consisting of a series of concrete pipes which can be fitted together and moved to wherever water is needed. Flow is regulated by sliding doors on the side of the pipe.

The plantations have more than \$40,000,000 invested in various systems, but they are constantly testing new methods.

Most of those currently being tested involve overhead sprinklers, both stationary and the whirling kind you use on your lawn. One type hurls its spray over an area of three or four acres. One big drawback of methods using fixed overhead pipes is interference with heavy farm machinery.

The biggest single problem in the drive for mechanization is development of a completely mechanical cane harvester. A small fortune awaits the man who can do for the Hawaiian sugar industry what the McCormick reaper did for the wheat growers and Whit-

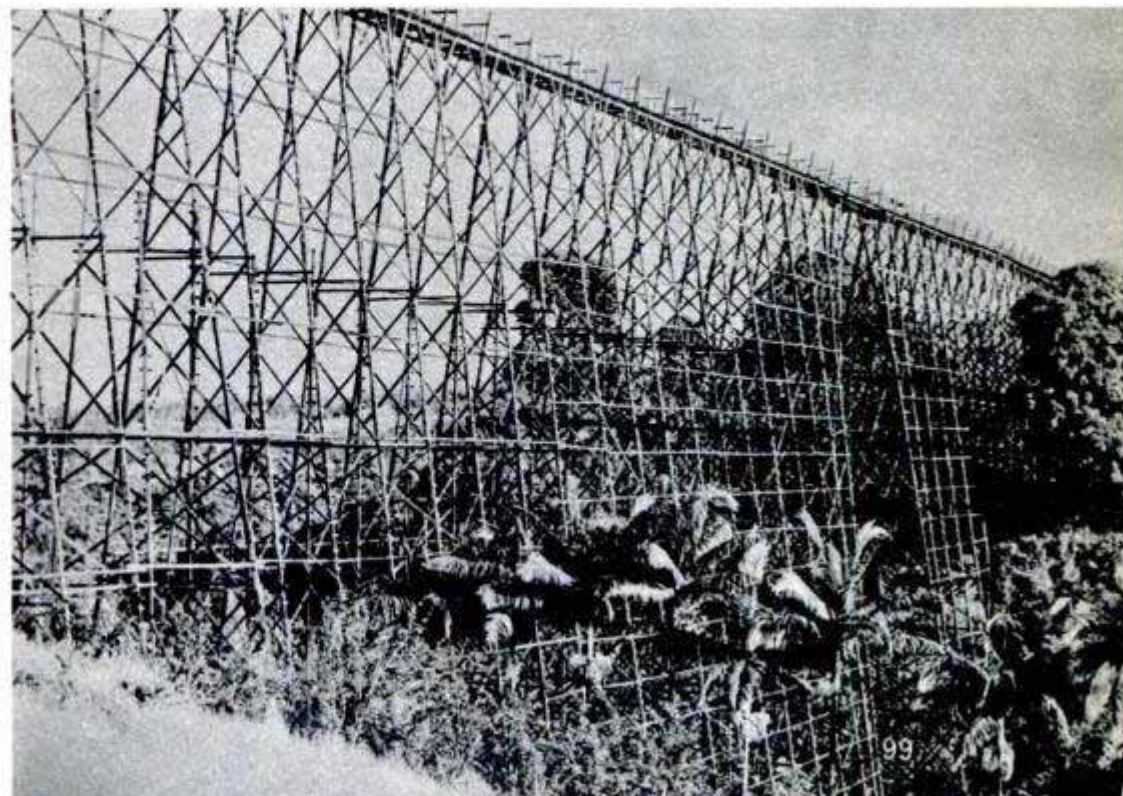


Mechanics working on one of the big rollers that squeeze juice from cane

ney's cotton gin for the cotton planters.

Hawaiian cane has a perverse tendency to grow without direction. It will progress along the ground for five or six feet, grow up for a couple more, shoot out at right angles, and continue in that aimless way for its full length of 30 or 40 feet. Mechanical harvesters, with sharp knives that shear the stalk off near the root, operate successfully in Florida and Louisiana, but in those areas the cane seems to have some sense of direction.

The nearest Hawaii has come to mechanical harvesting is a method developed during the war, known as "grab and rake" harvesting. There are several methods.



This looks like a scenic railway, but actually it is a cane-carrying flume bridging a gorge



Most Hawaiian plantations have their own narrow-gauge-railway systems, some with about 100 miles of track

One employs large crawler cranes like those used on construction jobs, but instead of a clamshell they are equipped with huge grabs. Steel fingers reach down into the cane, break it off at the roots, and load it onto waiting trucks or railway cars.

Sometimes the cane is bulldozed or raked into piles and then loaded by crane.

The choice of method depends on the terrain and field conditions.

These methods have serious drawbacks. Along with the cane often come trash, rocks, dirt and roots. Costly cleaning equipment has been installed, but rocks and other foreign matter still slip by, causing extensive damage to the crushing ma-

Specially built trucks, some carrying up to 50 tons, are rapidly replacing rail traffic on many plantations



chinery. On one plantation, a boulder weighing a ton was picked up by one of the grabs and got all the way to the mill before it was detected.

Four harvesters are now in various stages of development in the territory. Whether any of these holds the answer is anyone's guess, but there doesn't seem to be much doubt that the answer ultimately will be found.

Harvesting is also a problem which the pineapple industry has yet to solve. One of the chief difficulties is that pineapples ripen unevenly and it takes an experienced picker to select those ready for harvesting. No machine yet developed can tell a green one from a ripe one.

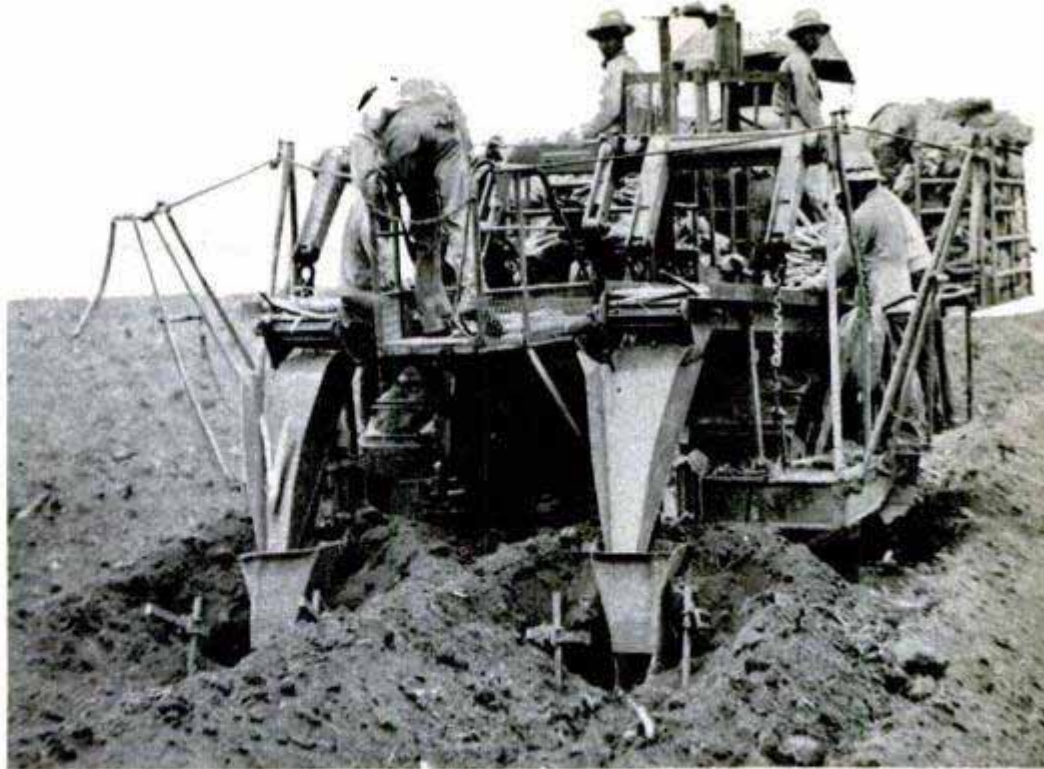
Prior to the introduction of the conveyor-belt system, pickers collected fruit in bags slung over their shoulders. It had to be carried to central collecting points every time it was filled. A full bag often weighs 100 pounds.

Under the new system, the conveyor, mounted on a truck, is extended right to the rows of fruit. The pickers simply place the pineapples on the moving belt, which deposits the load in a bin on the truck.

Actual planting of pineapple is still a hand process, but a large part of the work connected with it is done by very ingenious machines. Among them is a complex-looking contraption which comes on the field after it has been prepared for planting and lays long ribbons of mulch paper in parallel rows across the field. In the same operation the machine fumigates the field and fertilizes the soil. The paper is perforated in the center at even intervals, and the pineapple is planted through these holes.

The paper serves several highly important purposes: it regulates temperature, retains moisture, and keeps weeds out.

Much of the credit for these accomplishments



Evidence of mechanization in the field is this sugar-cane-seed planter

belongs to the Experiment Station of the Hawaiian Sugar Planters' Association and the Pineapple Research Institute.

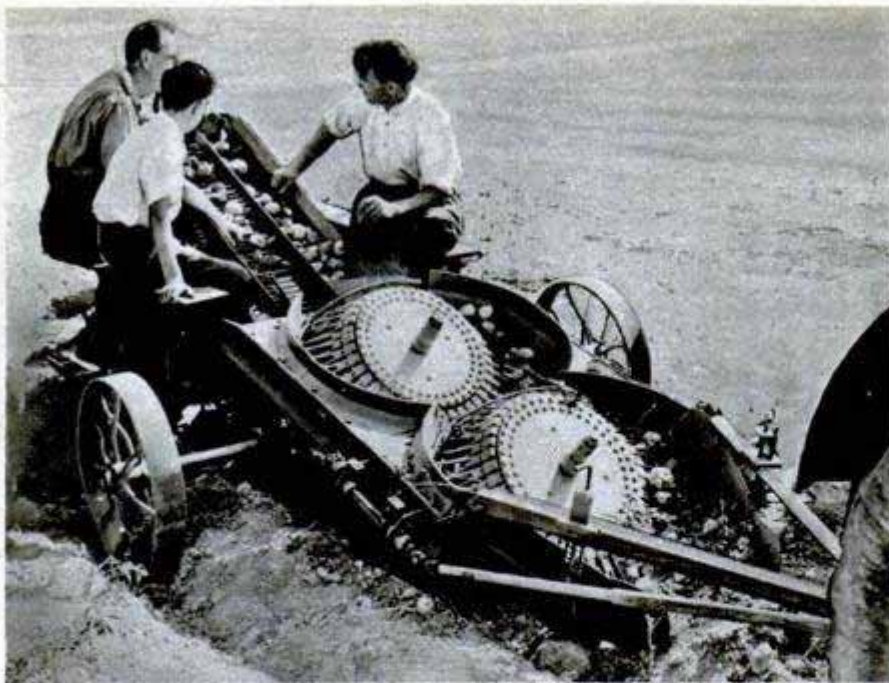
Both operate along similar lines. They are maintained on a cooperative basis by all members of the industry, and serve as a central intelligence unit and testing laboratory. They are manned by staffs of scientists and researchers that would do credit to any first-rate university.

Their work includes developing new varieties of cane, maintaining an accurate

(Continued to page 272)

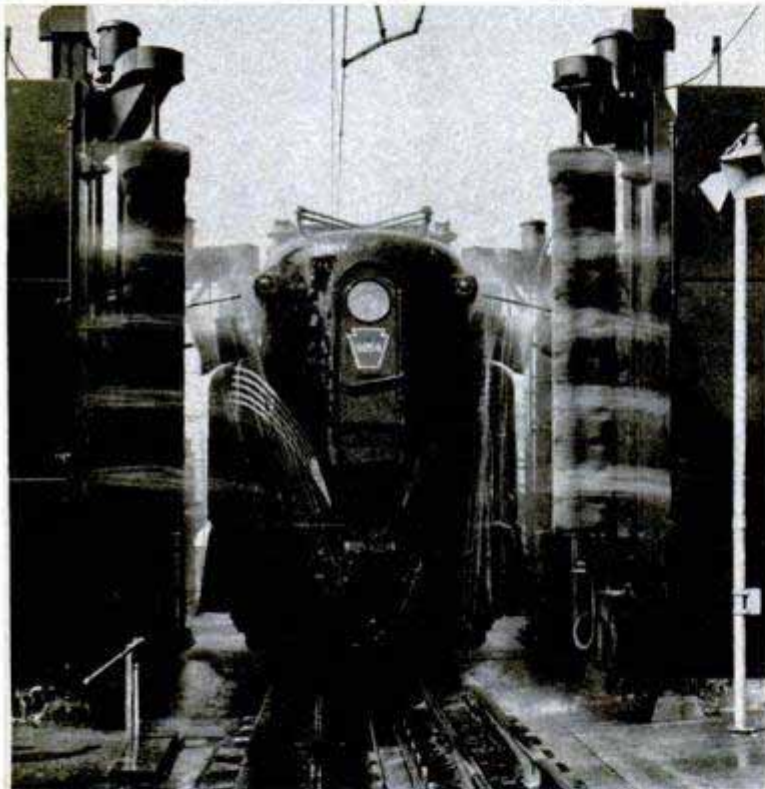
Irrigation ditches like this can deliver up to 50,000,000 gallons daily





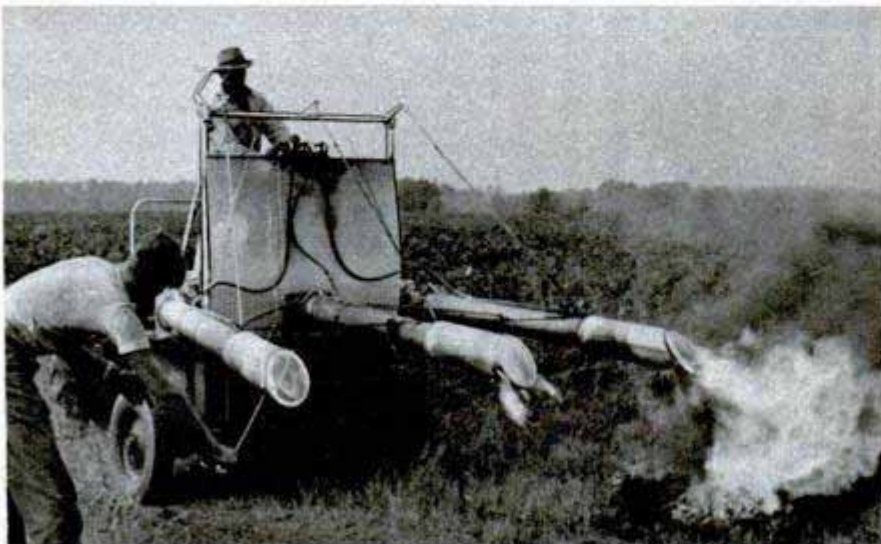
Tractor-Drawn Scoop Digs, Sacks "Spuds"

Drawn by a tractor, a potato harvester developed in England digs, cleans and sacks the potatoes in one operation. The harvester's two sections can be separated for ease of transportation. At the front end of the machine a digger lifts and cleans the potatoes, which are carried on a belt to bags. Stones are returned to the ground. The machine bags 3360 pounds per hour on a field producing nine long tons per acre.



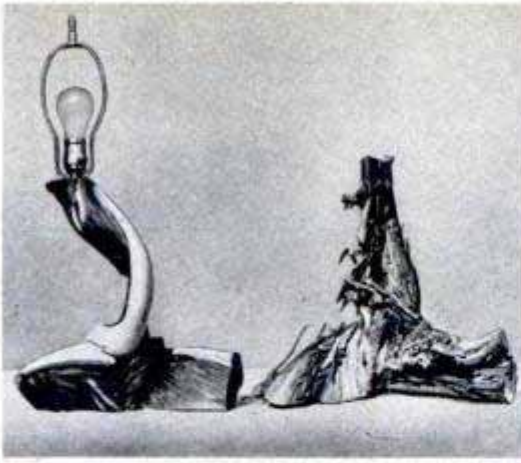
"Laundry" Scrubs Locomotives

Electric locomotives are scrubbed and polished by a 300-foot washing machine that employs revolving brushes and jets of steam and water. The machine, used by the Pennsylvania Railroad, launders one locomotive every 15 minutes, a job that requires almost three hours by hand. The installation towers 15 feet above the track on each side. A locomotive to be cleaned is stopped near the machine and a pusher takes over to move it through the brushes and water sprays. A solution of oxalic acid and cold water is sprayed from vertical pipes against the sides, and six large brushes swing into position to revolve against the sides, scrubbing off dirt and oil as the locomotive moves forward. Four large rotary washers emit high-pressure jets of hot water and steam to clean the frame, wheels, journal boxes and brake rigging. Eight more brushes polish the locomotive before a final rinse. Two men scrub the curved ends of the locomotives.



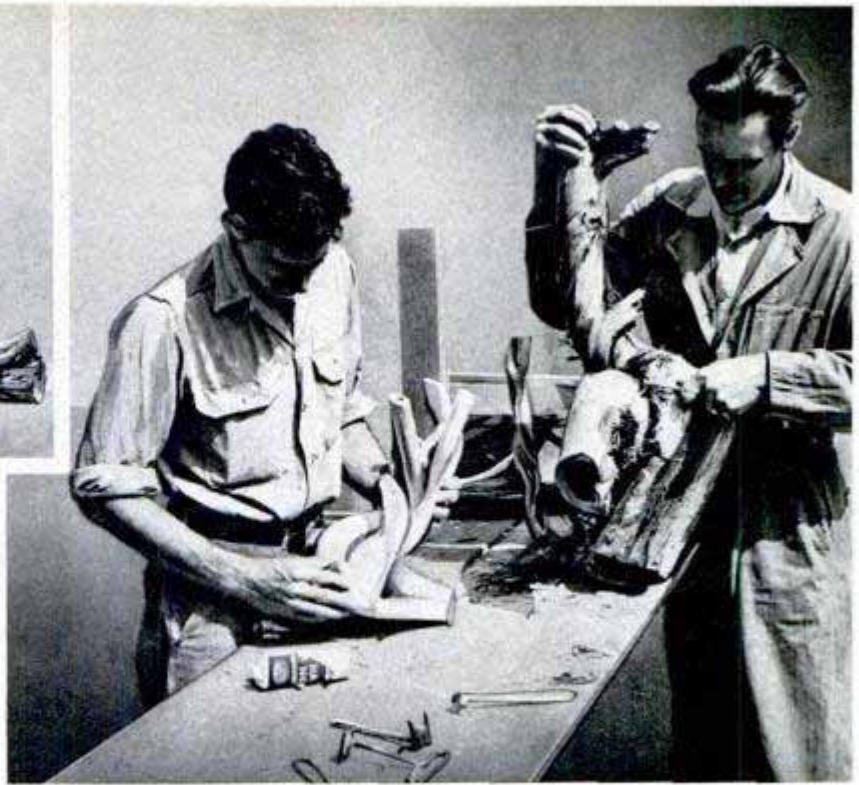
Potatoes "Toasted" To Speed Harvest

Bruising the tender skins of potatoes during harvesting is prevented by a "scorched earth" method used on Wisconsin farms. Flames from the jets of a weed burner kill the vines and allow the skins to toughen quickly. By reducing damage to the potatoes during harvesting, the process permits faster movement of the crop.

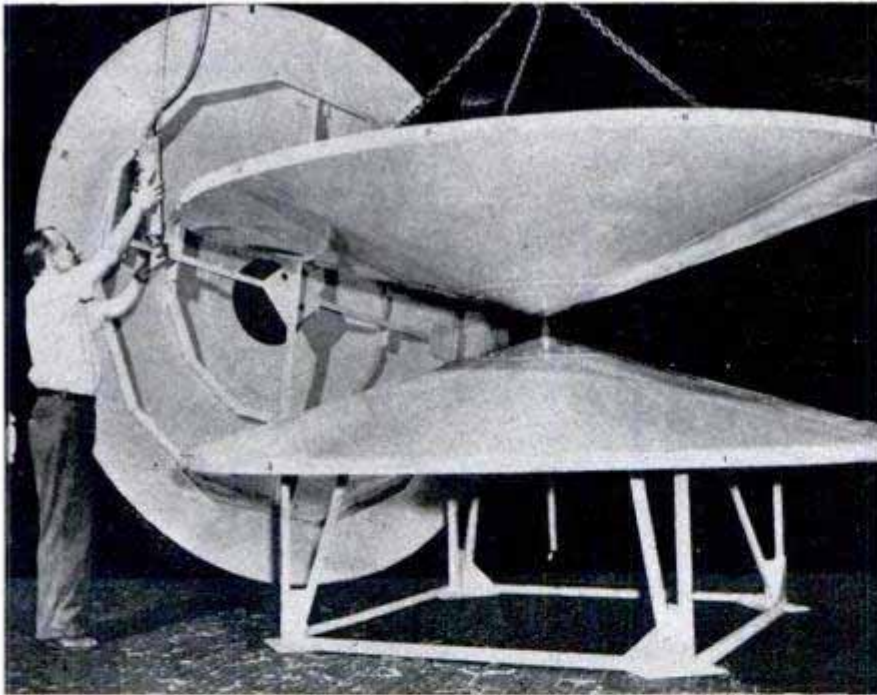


Wind-Blown Cedar Forms Lamp Base

Cedar burls, twisted by mountain winds, become two-color lamp stands after the bark has been removed and the wood polished. Lee Warren of Los Angeles discovered the unusually shaped burls while tramping through a remote forest in Utah. The cedar burls consist of sharply contrasted brown and white grained wood which takes a brilliant polish. Warren



brings the burls down from the mountains on a pack horse. After the burls are trimmed and polished they are coated with natural lacquer and a lamp socket and shade fitting are added.



"Chicken-Brooder" Television Antenna

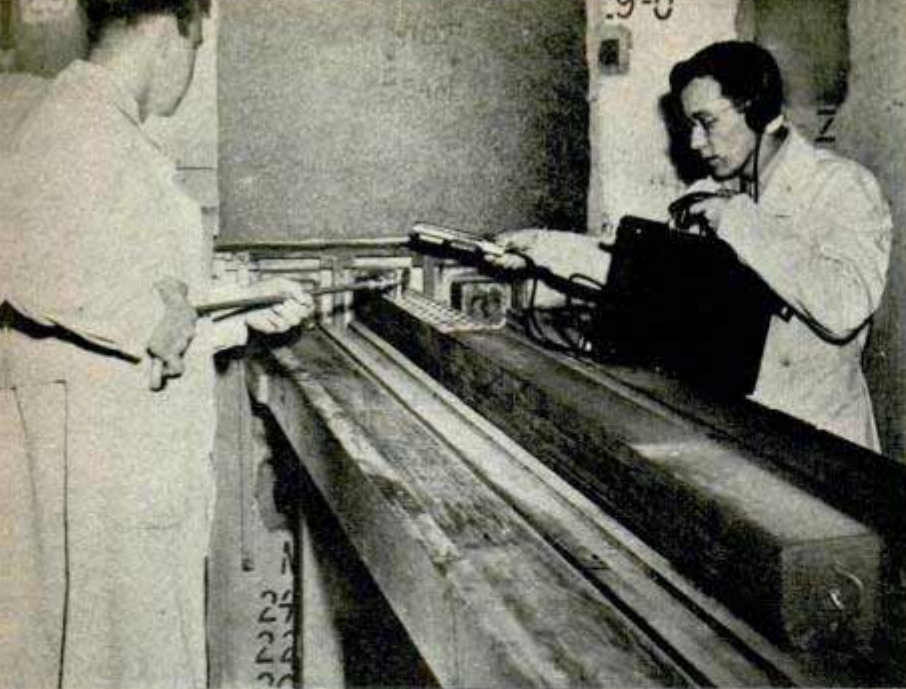
Sixteen times more sensitive than the usual vertical half-wave antenna, a new General Electric television receiving antenna looks like a chicken brooder when assembled. Designed for a Washington, D. C., station, the antenna will be used to pick up television signals from mobile field units for rebroadcast by the main transmitter.

Television receiving antenna is 16 times more sensitive than the usual type. The rear section is mounted above the other two to give it a chicken-brooder shape

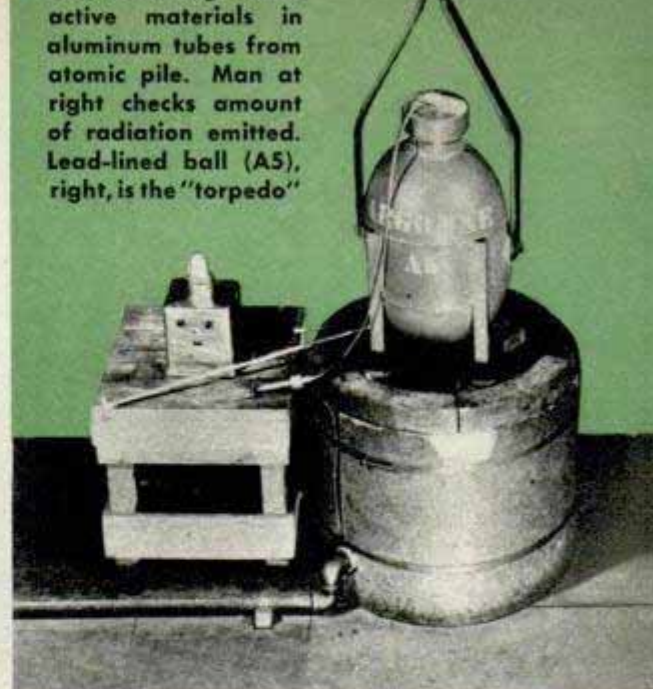
Pigs Fatten More Quickly When Drug Is Used to Retard Gland Action

Fattening pigs is hastened by a drug called thiouracil which checks the action of the thyroid gland. In tests at the New Jersey Agricultural Experiment Station at New Brunswick, a small amount of thiouracil was added daily to the rations of ten 200-pound hogs, while ten others were fed the same rations but without the drug. In 38 days, the group receiving

thiouracil gained a total of 610 pounds, compared to 470 pounds gained by the untreated hogs. The thiouracil group gained 100 pounds of weight for each 524 pounds of feed consumed, whereas the other group required 723 pounds of feed for a 100-pound increase. When available, farmers are cautioned not to use the drug until the last 45 days of the fattening period.



active materials in aluminum tubes from atomic pile. Man at right checks amount of radiation emitted. Lead-lined ball (A5), right, is the "torpedo"

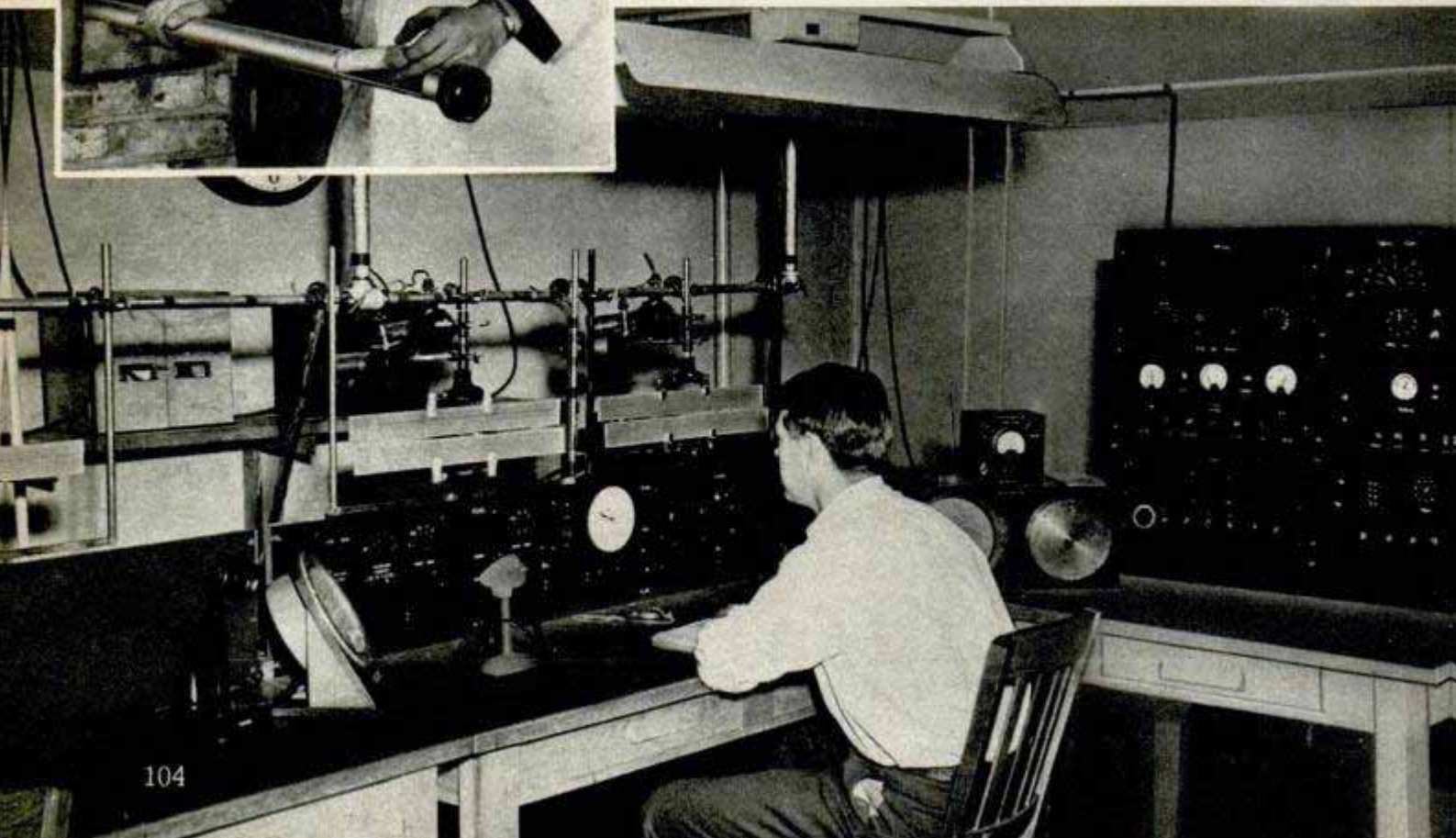


"Rabbits" Chase Atoms

"Rabbits" and "torpedoes" are two of many novel devices being used at Argonne National Laboratory near Chicago in hunting new fields for atomic energy. The former is a hollow container which darts into the atomic pile, or "furnace," with materials being subjected to only a few seconds of irradiation. It is moved through a pipe by compressed gas. The torpedo, a lead-lined ball, is lowered onto the furnace when large quantities of radioactive samples are to be extracted. Grappling tongs inserted through it lift out samples in such a way that practically no radiation escapes.

Left, putting "rabbit" into pipe for quick dash into "furnace." Below, control panels for graphite-moderated pile at Argonne

Argonne National Laboratory photos

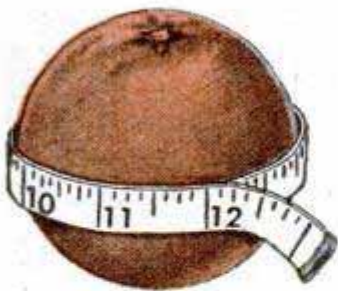


TEST YOUR SCIENCE

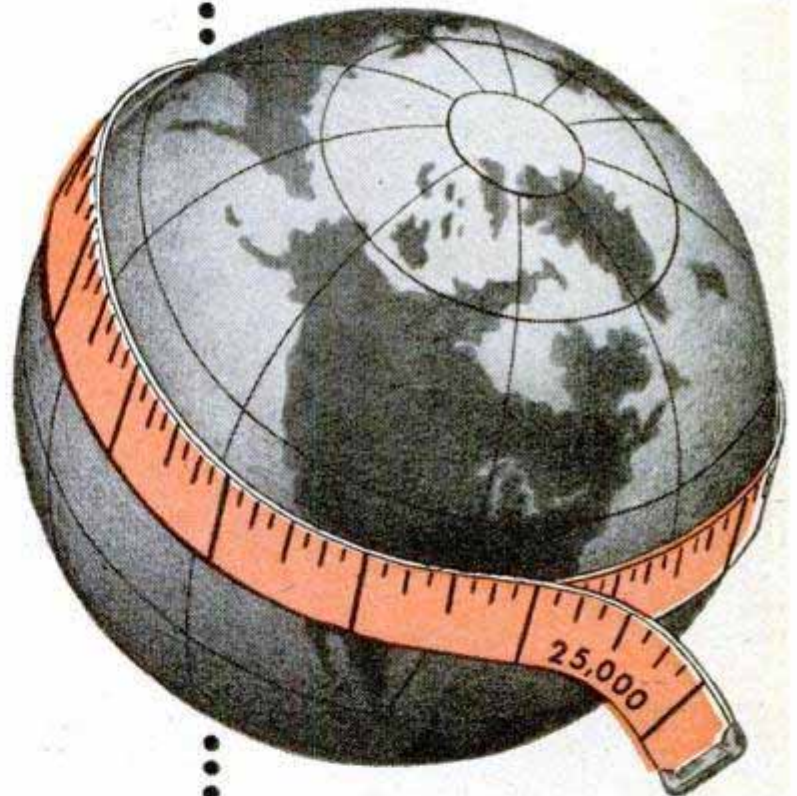
By Rex Taylor

TAKE an orange and a tape measure. Draw the tape snugly around the orange at its "equator." Let's say that it measures exactly nine inches around the waist.

Now let out the tape "belt" by three inches, so that its loop is extended from nine to 12 inches. If you stuffed paper between the orange and the tape, all around, you would find the tape was about $\frac{1}{2}$ inch distant from the orange at all points. In other words you have increased the circumference of the tape loop from nine inches to 12 inches ($33\frac{1}{3}\%$) and its diameter is an inch wider.



i.q.



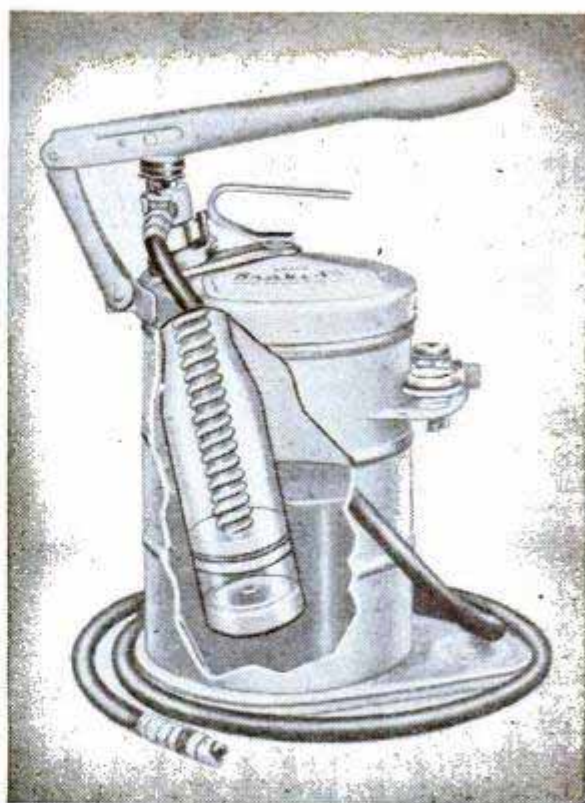
NOW

Imagine yourself drawing tightly around the earth at its equator a tape measure 25,000 miles long. For the sake of the problem we'll say it's exactly that distance. Now lengthen the tape loop three inches, as you did with the orange. What is the width of the space between the earth and the tape measure, extended to 25,000 miles and three inches?

Answer on Page 238



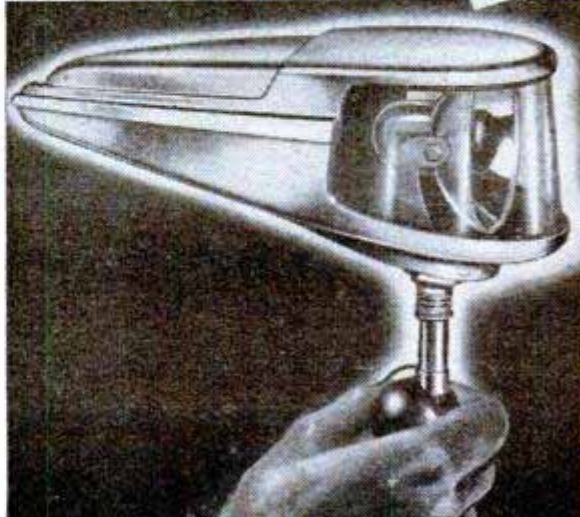
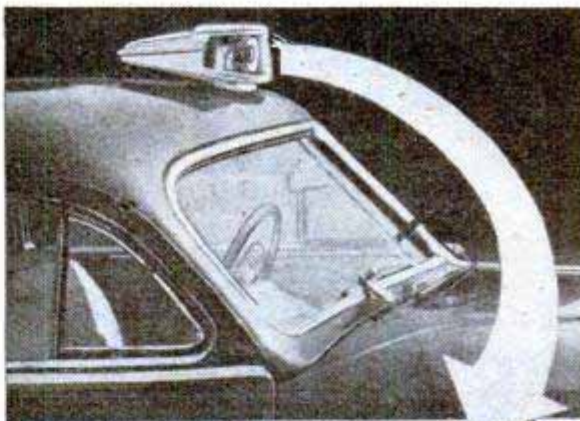
CARRYING SACK holds 25 pounds of sand to provide traction on ice or snow. With convenient handles and a long pouring spout the sack helps homeowners lug sand out to slippery driveways and walks, can be carried in car trunk

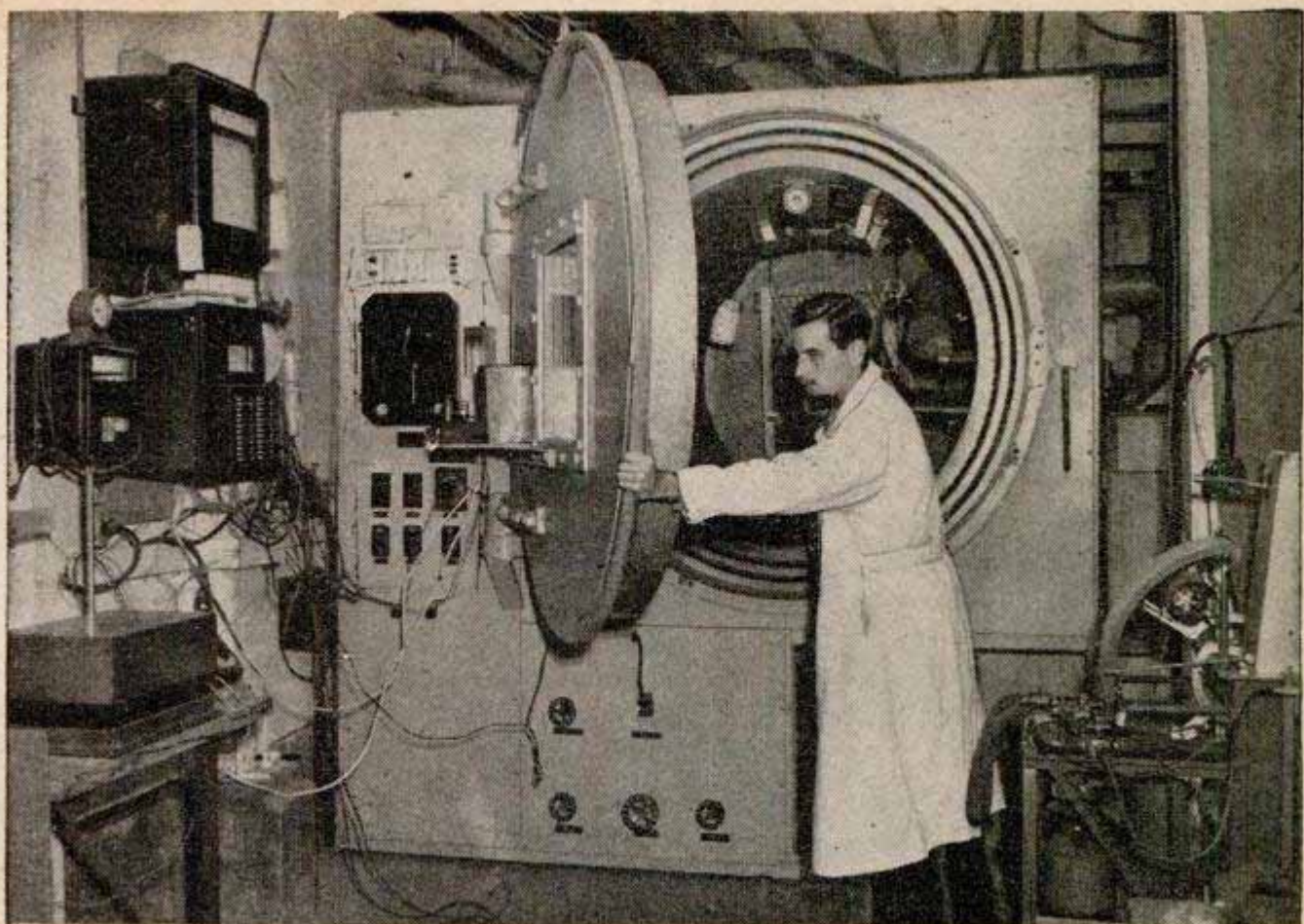


SPRING-OPERATED PUMP injects fluid into automobile brakes without hazardous bubbles which sometimes occur when a compressed-air pump is used and which can cause brake failure

TIRE MOUNTER rolls tires onto the rim as easily as turning a crank. Bottom photo shows tire being mounted merely by turning the crank after tire is centered on the machine. Top, tire is taken off rim by inserting bar and rotating

ROOF-TOP SPOTLIGHT for autos is controlled by a knob inside the car just above the windshield. The control knob switches on the light, directs the powerful beam, or locks it in any position





In this UCLA "hot box" Dr. Craig Taylor withstood record 262-degree heat. Many-buttoned potentiometer, below, records temperatures of parts of body

The BURNED-NOSE CLUB

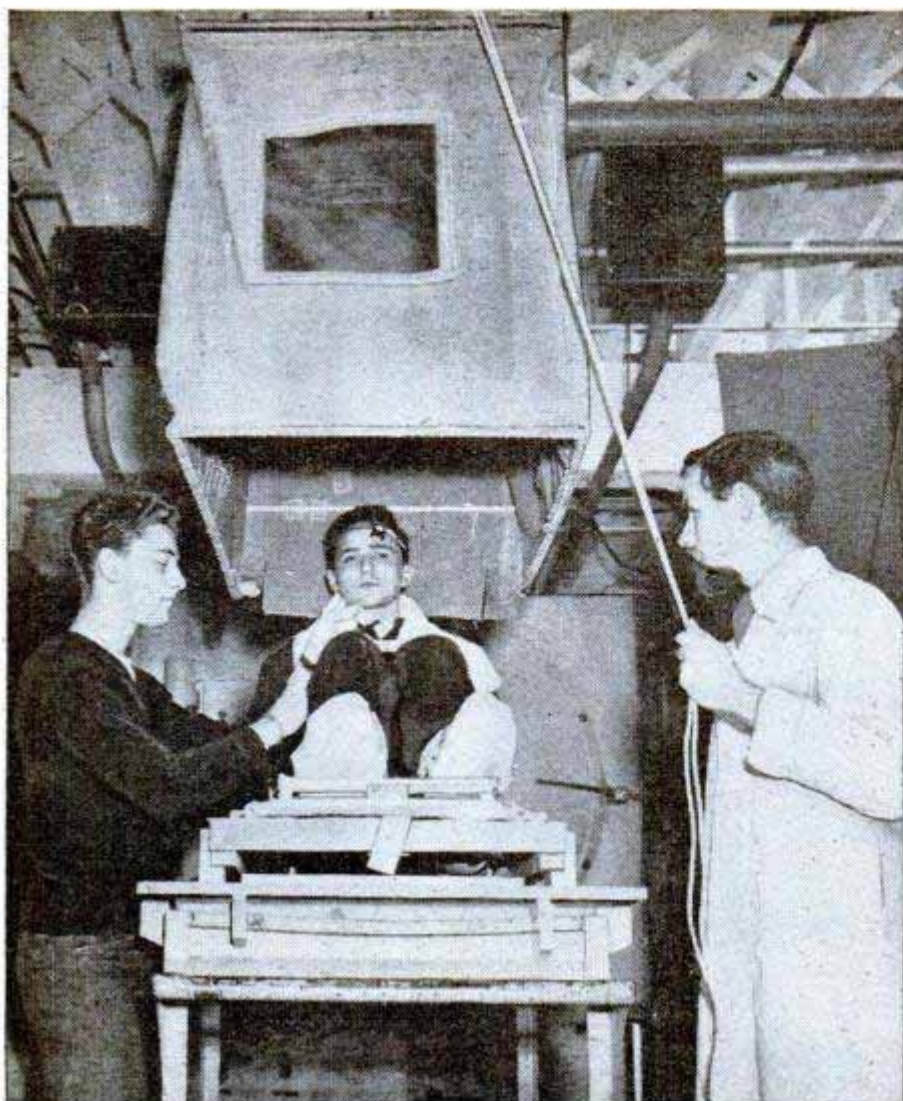
WELL, BOYS, here's another candidate for the Burned-Nose Club," said Dr. Craig Taylor.

Stripped to his shorts, he fastened eight thermocouples to his arms, legs and body, stuck one up his nose and shoved another into his mouth. He looked like a fantastic figure in a Salvador Dali painting.

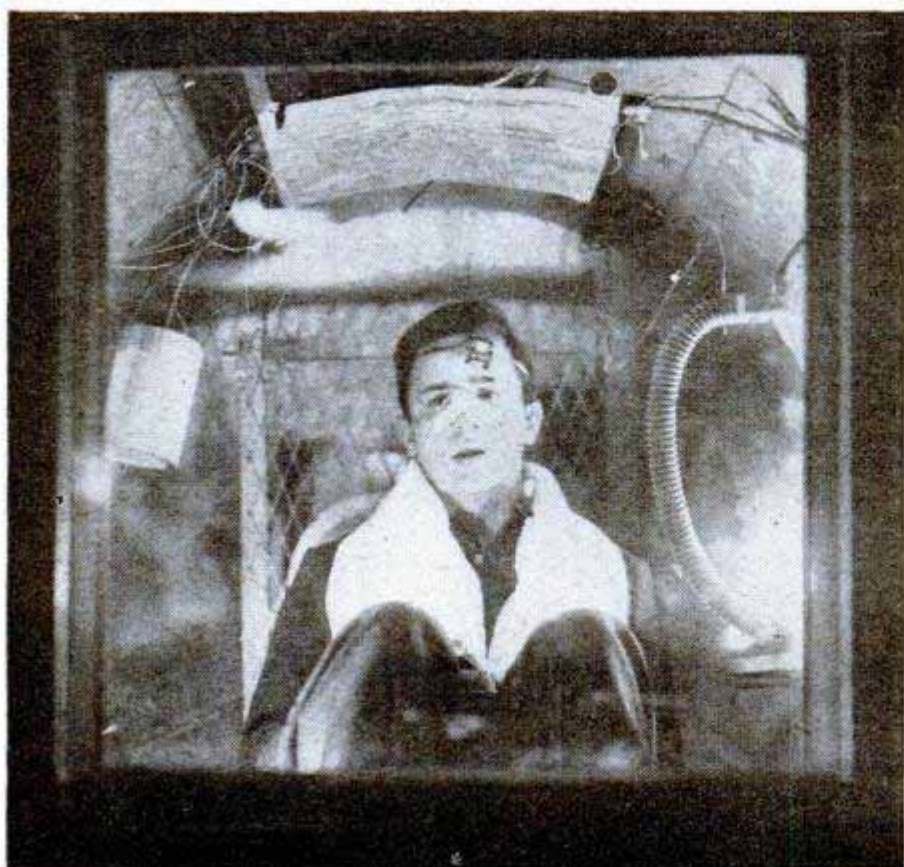
Then he put on twill-weave, summer-weight trousers and jacket of the United States Air Force. His sockless feet were thrust into a pair of white, canvas overboots with a felt lining. To protect his ears, he wrapped a towel around his head. Finally he pulled on a pair of pilot's gloves.

Dr. Taylor, 38, sandy-haired, stocky, an associate professor of engineering at the University of California at Los Angeles, was ready to try for a new heat-tolerance record. Although not related to Sam McGee of Robert Service's famous poem





Subjects are "conditioned" briefly beneath heavy canvas hood before entering test chamber. Heating element under seat warms air. Below, photographed through glass door, subject shows effects of 200-degree-plus heat



(who never really got warm until he was cremated) Dr. Taylor was going to enter a scientific oven at one of the highest temperatures that any man had ever voluntarily submitted himself to—and lived.

This was no trick—no circus sideshow—no Hollywood headline stunt. It was one of a number of serious experiments on human heat tolerances in the brand-new field of biotechnology. This research at UCLA has special and direct application to the supersonic speeds of the near future. The problem of jet aircraft is not cold but heat.

Fast-moving jet planes scoop air into their ram ducts. The ram heating effect may increase cockpit temperatures considerably. And the faster the ship flies the greater the heat. For example, at 600 miles an hour, the inside temperature is increased approximately 60 degrees over the air outside; at 800 miles an hour it is 120 degrees more, and at 1000 miles an hour it is raised 180 degrees.

There is also frictional heating of the plane's wings and fuselage as it swishes through the air. This may be as high as 85 to 100 percent of the ram heating effect. These high temperatures generated may be one of the important factors in limiting the speed at which man can fly.

Relatively simple refrigeration systems have been installed in cockpits of P-80s, P-84s and other jet planes to keep the thermometer at a comfortable level.

But what if a pilot forgets to turn them on? What if they get out of whack? Or if they are shot away in combat?

Research in the laboratory will tell transport

and military pilots and passengers just how long they can remain in furnacelike temperatures. Dr. Taylor's experiments already seem to indicate that our fear of heat may be partly mental and that man can exist in excessive temperatures somewhat longer than is popularly thought possible. An extra two or three minutes may mean that the pilot can make a landing field, put a strip of treacherous ocean behind him or reach friendly territory in which to bail out.

"Wheel me in," Dr. Taylor called as he climbed into a small seat on rollers—resembling the pilot's seat in a fighter plane.

The heat chamber is cylindrical in shape, five feet wide and looks like a giant Bendix washing machine. Seventy cubic feet of heated air a minute is pumped into the chamber. It is sheathed inside with sheet metal, insulated heavily with rock wool and is reached by a heavy, circular door. During the war it was used by Ryan Aircraft Company in San Diego to test instruments and was acquired recently by UCLA through the War Assets Administration.

Two assistants heaved open the door and a blast of searing air swept out. The small seat on which Dr. Taylor rested was pushed inside and the door slammed shut.

"How's it feel, Doc?" he was asked through the inter-com system.

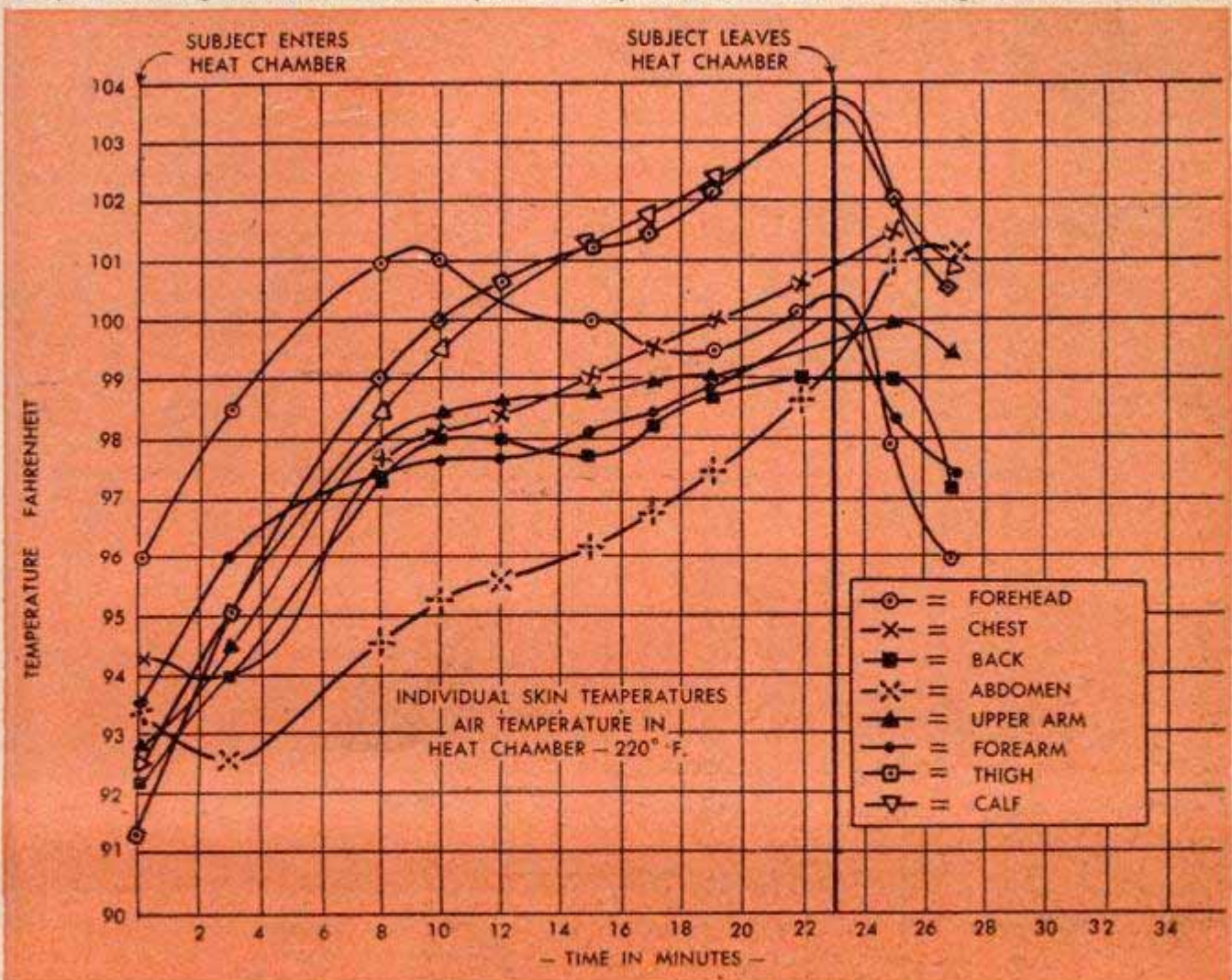
"Hot as blazes!"

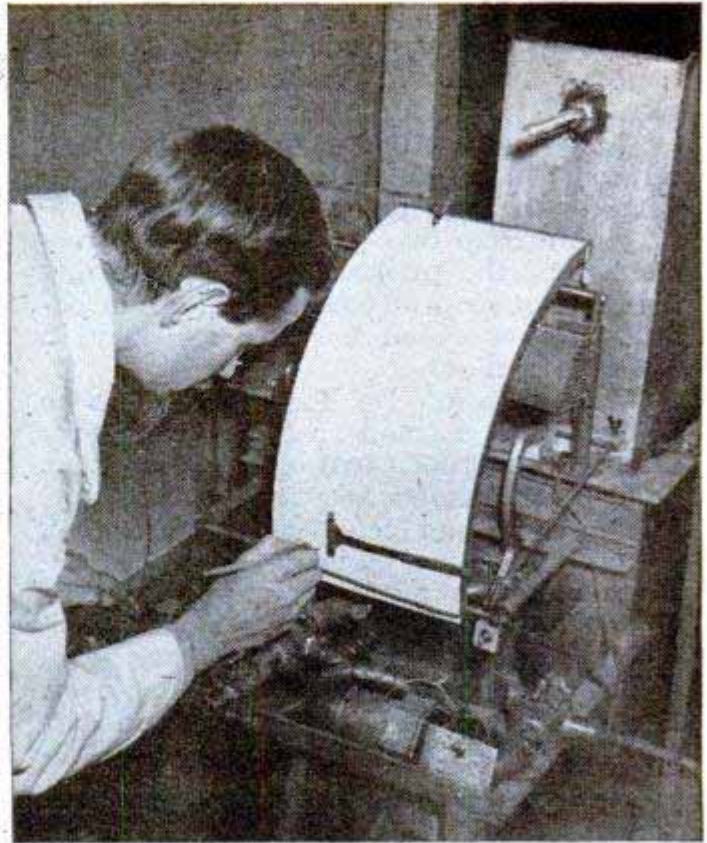
The thermometer, which had swung down to 175 degrees Fahrenheit when the door was opened, climbed rapidly back to 240 degrees. Through a glass window in the heavy door, the researchers watched Dr. Taylor's face grow red as a boiled lobster. After three minutes he broke into a profuse sweat which brought some relief.

At 14 minutes 30 seconds, he told his assistants that he'd had enough. The temperature inside had averaged 250 degrees and during the last two minutes had touched 262 degrees—a new record for the series. (Water boils at 212 degrees!)

Trained as a physiologist at Stanford University, Dr. Taylor became interested in biotechnology during the war when he served at Wright Field as a captain in the Air Force. After the war he came to UCLA and joined the College of Engineering to continue his experiments. He formed a research team consisting of a physiologist, W. V. Blockley, and an engineer, R. H. Holloway. Student assistants Philip Elliot, Sidney Freedlander and Lloyd Barnes round out the crew. All take their turns, acting as subjects and experimenters.

Graph illustrating how skin on different parts of body reacts to intense heat during 23 minutes in hot box





Respiration valve, left, separates exhaled and inhaled air so that volumes can be measured on meter at right

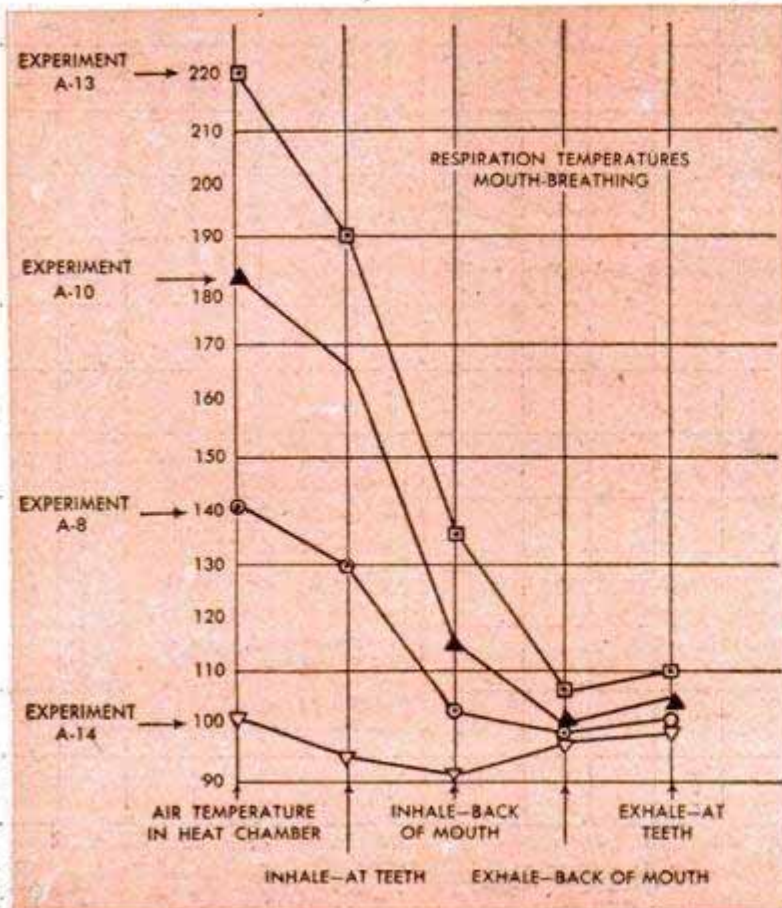
Heat tolerance is only one of several biotechnological problems being investigated by scientists at several university, industrial and Army and Navy laboratories in the United States. Some are working on acceleration and G-forces, some are engaged on high-altitude and lack-of-oxygen

experiments, some are devising plane controls so that man's brain and muscles may keep up with tremendous speeds at which the jet and rocket airplanes of the future will operate.

These problems of flight are not so much mechanical as they are physiological and psychological. Men trained in medicine often understand them better than those trained in mechanics. In the final analysis though, the physiologist and the engineer must work together to solve the puzzling aspects of super speeds.

Dr. Taylor believes man's fear of heat is probably as much mental as it is physical. Since the days of cave-living and club-wielding, human beings have been frightened by fire. Modern man is afraid of heat because he is not sure how much of it he can stand before setting into motion what science calls "irreversible processes"—death.

It is more than likely, Dr. Taylor believes, when tolerances are charted and known, that the Army and Navy will include heat indoctrination in their pilot training courses. Cold indoctri



As chart indicates, body's cooling system lowers temperature of air as it is drawn into and out of lungs during respiration

nation—designed for men who might have been compelled to bail out into icy water or over arctic lands—was taught in some cases during World War II. As supersonic planes come into general use, heat indoctrination may become important also.

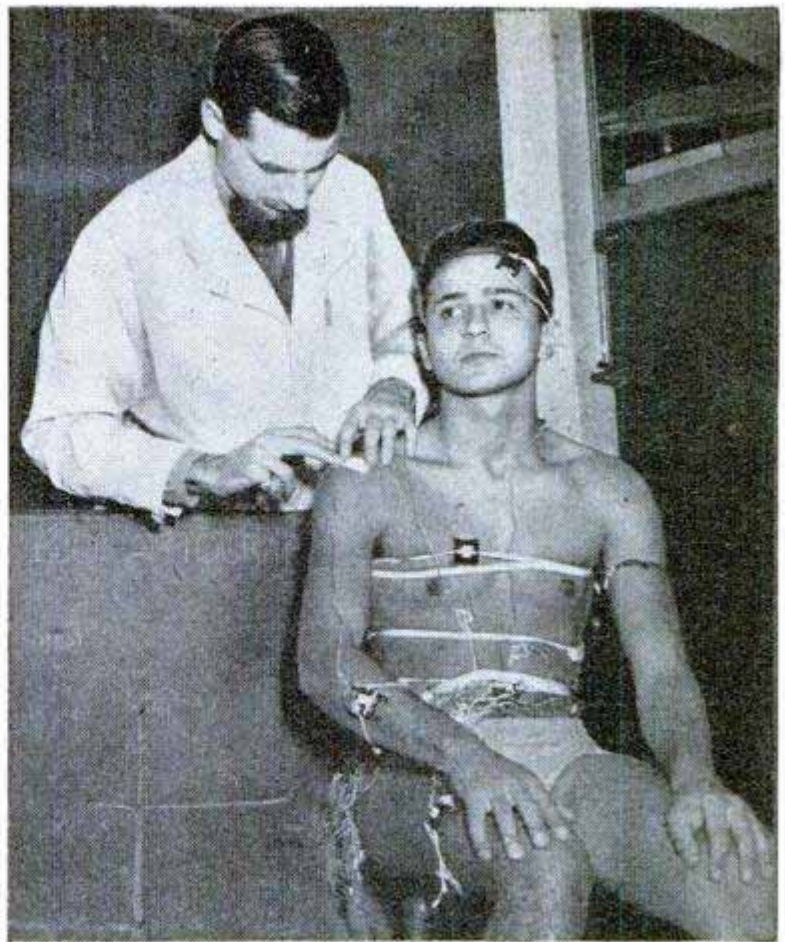
How can the human body withstand terrific temperatures 40 degrees or more above that of boiling water? Doesn't such ovenlike heat roast the skin of the face and hands—sear the eyeballs—scorch tender lung membranes—make the blood boil?

Surprisingly, none of these dire calamities occurs in the first quarter hour at 250-degree heat.

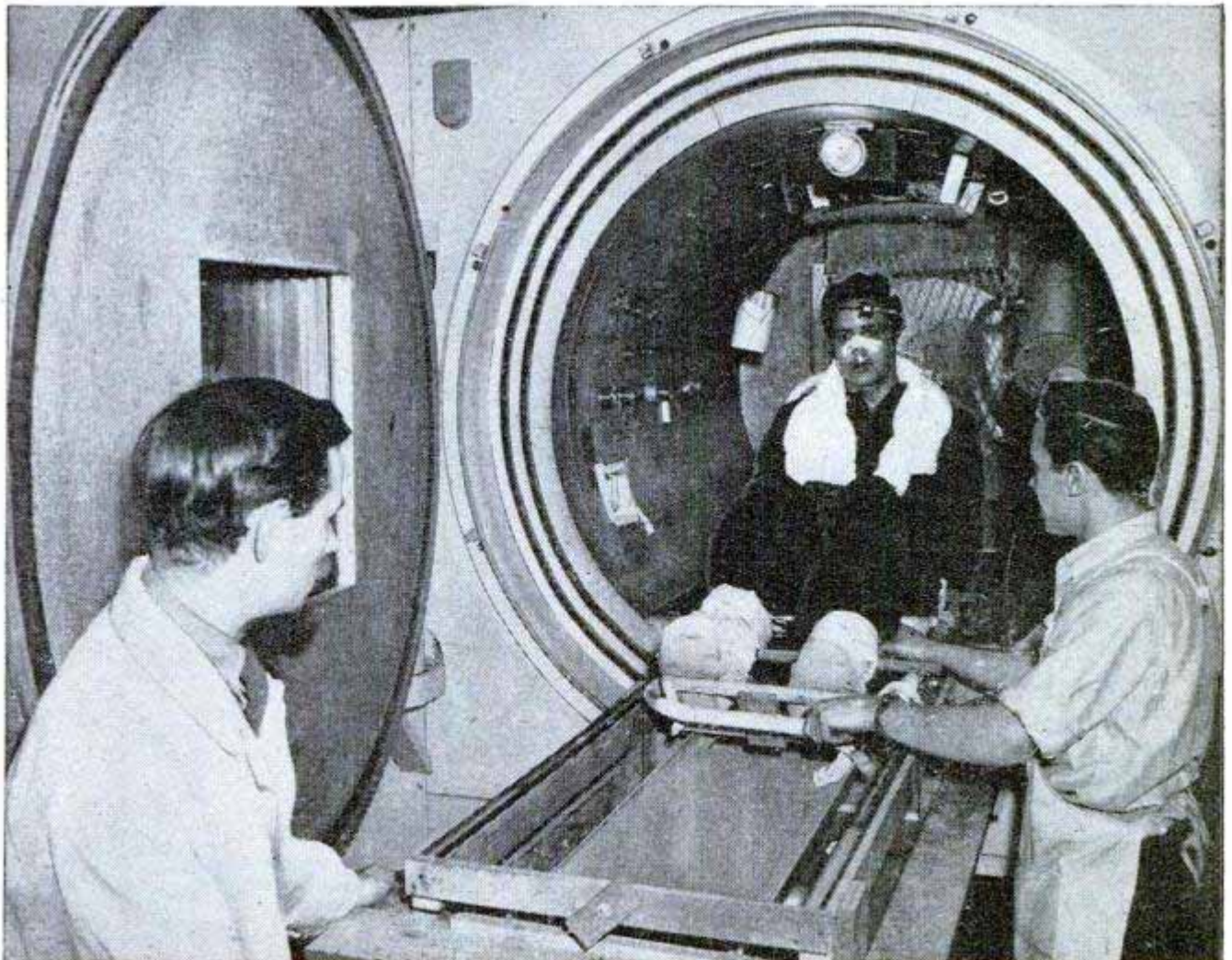
Soldiers from relatively cool areas like Colorado found they could stand the sweltering heat of the New Guinea jungle and the Arabian desert. In time they almost forgot their discomfort. So has it been with experimenters working with the "hot box."

Subjects are told what to expect and what temperatures others have been able to withstand.

(Continued to page 276)

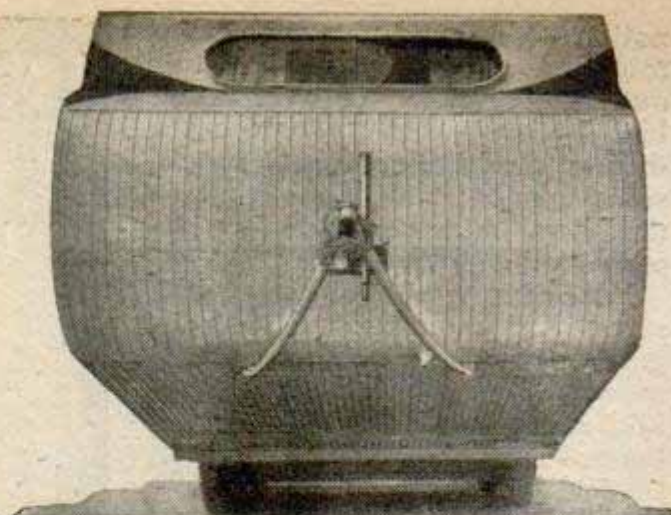


Above, physiologist checks harness which measures heat at eight points on body. Below, subject rolls out of chamber after test





Left, all-metal kitchen has a built-in range, icebox and cupboards. Right, front view shows clearly the absence of heavy steel framework



Frameless Trailer Is Light, Strong

Of semi-monocoque construction, a lightweight trailer coach has no need for the conventional heavy steel frame. Instead, the wheels and tow-bar supports are secured directly to the corrugated under-floor structure of aluminum alloy. Internal wall and roof structural members consist of aluminum-alloy Z-sections spaced to provide strength to the body shell. Because of its design, the trailer can be built in several basic parts such as the floor, sides, roof and ends, and assembled later. Wheels are independently sprung. Only 16 feet long, the trailer will accommodate four people.



Above, although only 16 feet long, the trailer sleeps four comfortably. Double bed in foreground folds into the wall during the day. Wardrobe closets are on the left wall. Below, well streamlined, the lightweight trailer tows easily. Windows on all four sides provide good ventilation



Flashing Lights Aid Piano Students

Students learning to play the piano are given visual instruction by a mechanical teacher that aids the music teacher in demonstrating the proper keys and fingers to use. A large plastic panel is installed above the teacher's piano. The panel includes a replica of the keyboard, a staff, musical symbols and an outline of two hands. A control cabinet is installed within the teacher's reach. As she plays the piano, the keys activate lights on the master keyboard to show the students the proper notes to strike on dummy keyboards held in their laps. Switches in the control cabinet permit the teacher to light up the proper fingers on the hand panel and the proper musical symbols on

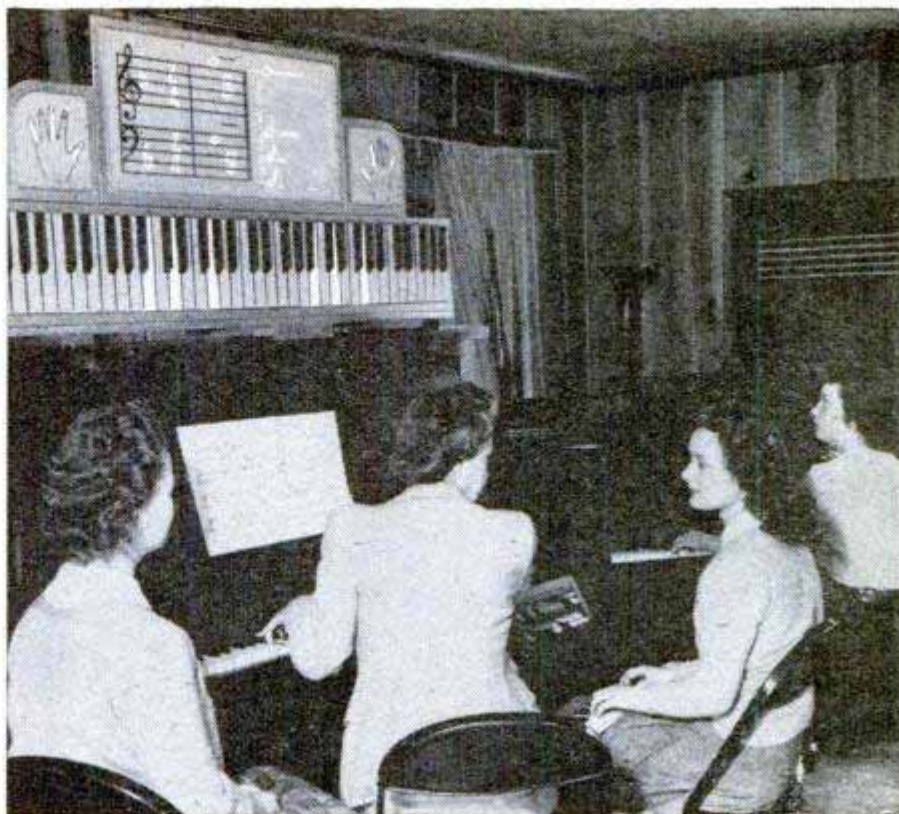
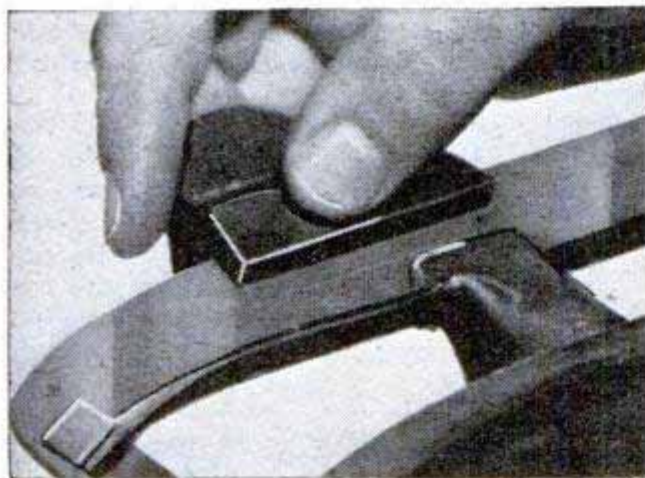


Photo from American Cyanamid

the staff. Several students, each equipped with a dummy keyboard, learn to play at the same time using the teacher's aid.



Pocket-Size Skate Sharpener Handy for Use at the Rink

Skates can be sharpened at the skating rink with a pocket-size sharpener that has a carbide blade. With the skate held in a horizontal position, the sharpener is drawn along the runner from toe to heel with smooth, steady strokes. No skill is necessary and hollow-ground blades are sharpened in a few minutes. The tool is slotted to fit around the skate blade and it is designed for use in either the left or right hand. Its aluminum body makes it light in weight and rustproof.

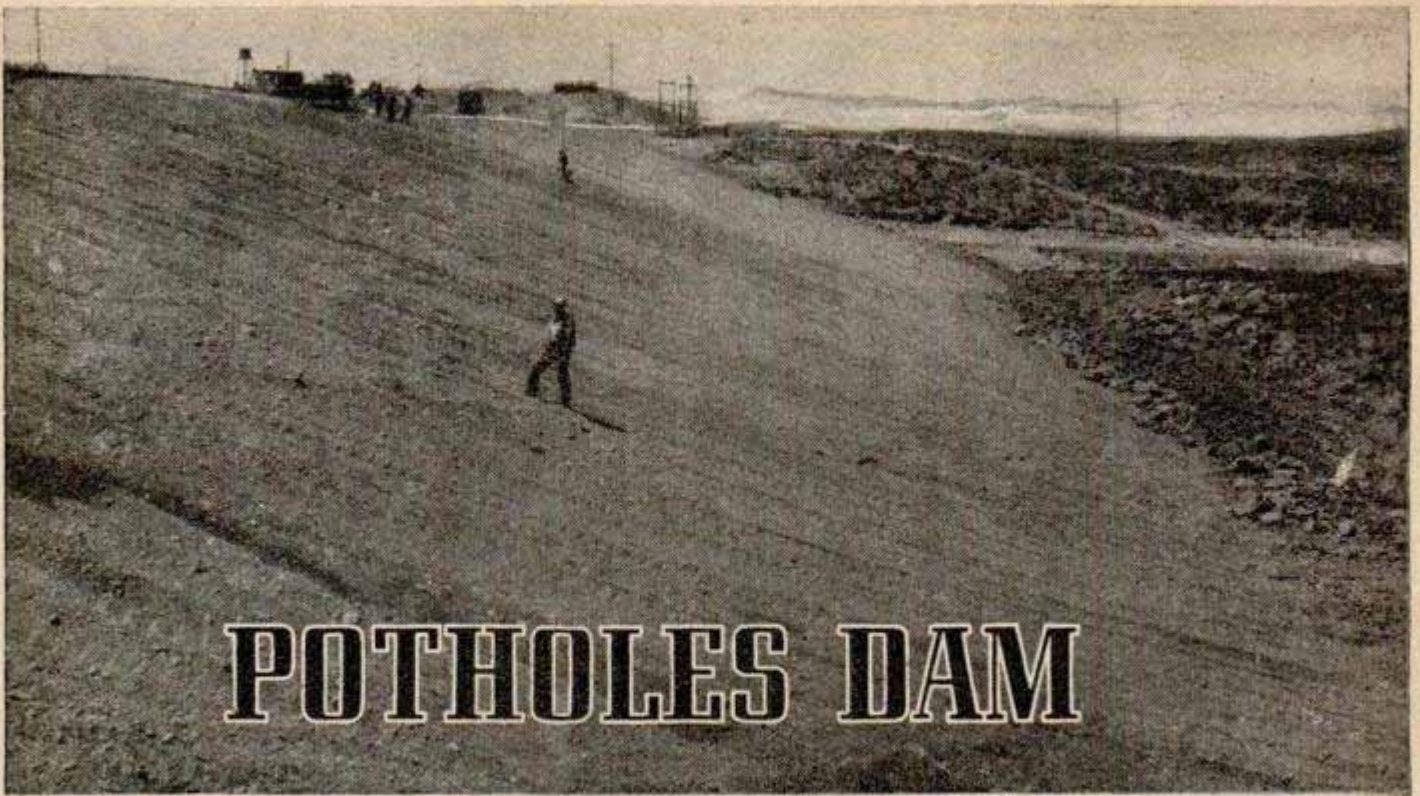
Junior Can "Drive" Now →

Children can "help" dad drive the car with a toy steering wheel that fastens to the dashboard. The wheel is made of hard rubber and is held in place by a suction cup. Sample-size drivers even have a horn to toot while steering.

Electric Slippers Soothe Feet

Soaking tired feet in hot water is old-fashioned now that electric slippers do the same thing with less mess and bother. The slippers are wired with a heating cord. You slip them on, plug them into the nearest outlet and in a few seconds your feet relax.



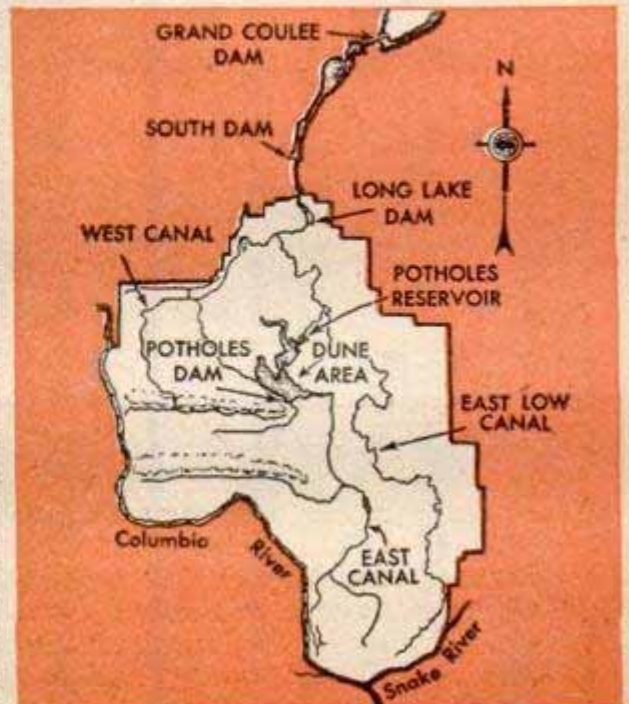


POTHOLES DAM

Layer upon layer of firmly tamped silt, clay, sand and gravel will be topped by three inches of rock. Below, machines at site



TAKING its name from the potholes, or ponds, in a desolate area in eastern Washington, an earth-rock storage dam is under construction to create a garden spot of 270,000 acres of land now barren. Potholes Dam will be 3½ miles long and the bulk of its structure will nearly equal that of giant Grand Coulee Dam, 66 miles to the north. The new dam will have a lake-reservoir covering 47 square miles, with fine sand beaches. Water for the reservoir will come from drainage of nearby land and irrigation canals.





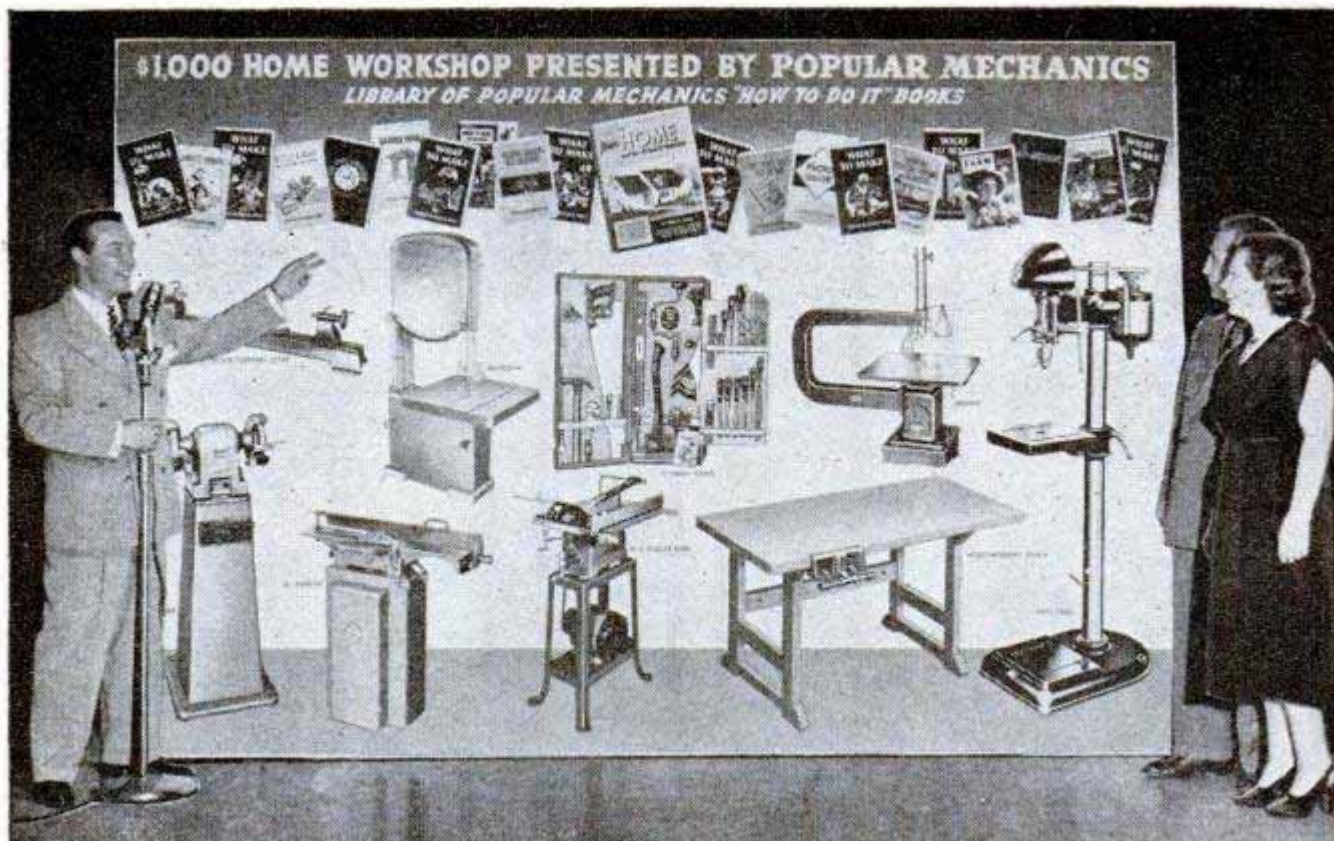
Above, pneumatic hammers tamp the soil firmly in places which sheep's-foot rollers cannot reach. The hammers compact the soil mixture so tightly that water cannot flow through it

Above at right, Phil C. Royer, a superintendent, uses short-wave radio to summon a mechanic to repair a disabled dragline. Radio equipment and roving mechanics prevent many bottlenecks

Right, close-up of a pothole. Big boulders now reduced to tiny pebbles ground out this hole thousands of years ago. When the pothole is cleared of rocks it will be filled with concrete

Below, dunes scene in the potholes area of the Columbia Basin Project. Potentially rich farm land surrounding this desolate region will be served by costly network of irrigation canals





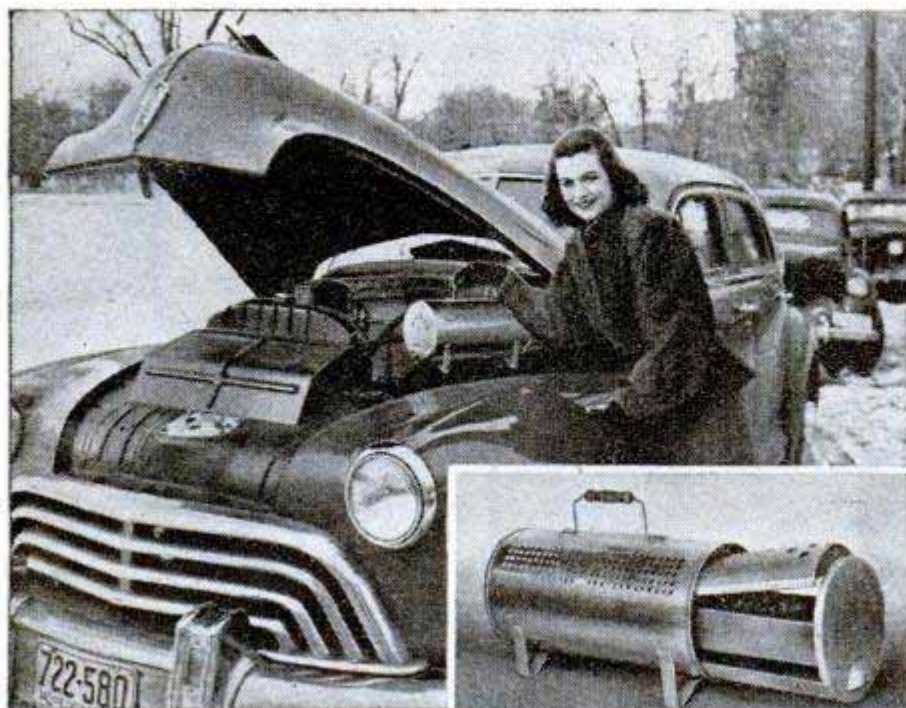
"MISS HUSH" WINNER GETS DREAM WORKSHOP

Workshop equipment that would be the dream of any home craftsman was the prize given by *Popular Mechanics Magazine* to the lucky winner of the "Miss Hush" contest recently on the Truth or Consequences radio program. The Craftsman Editor selected for the prize seven valuable power tools, a woodworker's bench and a kit of 39 hand tools.

Winner of the "Miss Hush" contest was Mrs. C. T. Subbie of Fort Worth, Tex. The tools constituting this basic set delivered to her by *Popular Mechanics* were a bandsaw,

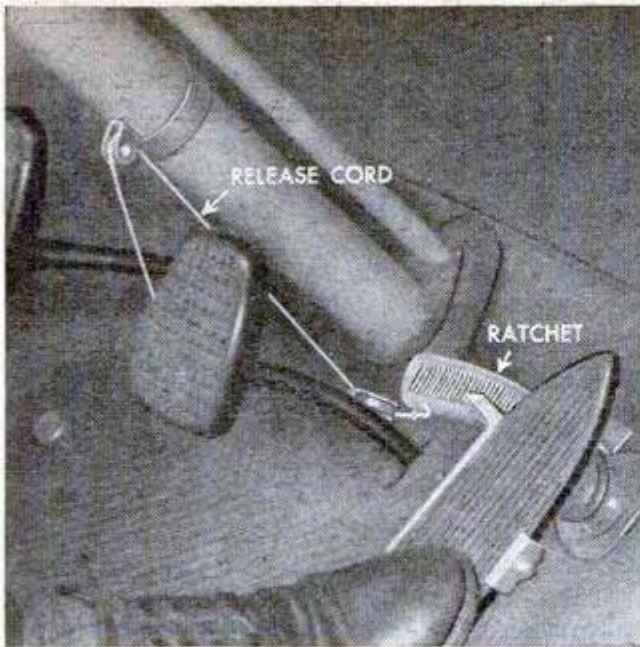
jointer, jigsaw, eight-inch circular saw, drill press and six-inch grinder—all complete with motors and stands—and a wood-turning lathe, plus the packaged set of hand tools.

So that the owner will have full instructions on proper use of the tools and a variety of projects to build, a complete library of *Popular Mechanics* how-to-make-it books—What to Make, Shop Notes, the Garden Book, Home Kinks, Useful Ideas and many other workshop pamphlets—was presented as part of the prize.



Auto-Engine Heater Burns Charcoal

Motorists can carry a heated garage right along with them in the shape of a compact charcoal heater. It heats without flame and requires no electricity. The heater consists of a removable heavy metal fuel tray and an outer casing of high-grade aluminum 14 inches long, 6½ inches wide and 6½ inches high. Fuel capacity of 18 briquets maintains an even heat for 12 to 30 hours. The heater can also be used for heating an insulated truck, cabin or duck blind.



Control Holds Accelerator Pedal

Cars or trucks are held at any desired speed by a control that holds down the accelerator pedal. The control, which fits all conventional pedals, releases automatically when the brake is applied. A projecting arm fastened to the pedal fits grooves in a ratchet on the floorboard. When the pedal is depressed the two parts lock to hold down the accelerator. A cord from the ratchet is fastened to the brake pedal, releasing the control at the touch of the brake. For shifting gears and normal driving the control can be released by moving the accelerator slightly to the left. The control can be installed in a few minutes.



Adhesive "Welds" Carpet Padding

Strong enough to join sections of carpet padding without reinforcement, a rubber adhesive can also be used with binding tape or sewing to form a permanent seam on carpeting. On padding, the compound is painted on both square-cut edges. Held together and allowed to cure for an hour, the two sections become so firmly bonded that a strong pull tears the padding before it opens the seam. The material also makes carpets skidproof.



Huskies in Alaska Pull Cart Mounted on Two Oil Drums

When arctic ground thaws and becomes soft during the summer, an Eskimo at Point Barrow, Alaska, replaces his conventional dog sled with a novel vehicle. A cart with two 50-gallon oil drums as wheels

rolls him across the loose earth. His team of huskies pulls the sled in winter, when the tundra and streams are frozen, and switches to the cart when the snow disappears in early summer.

Every day new products for homes and workshops, farms and factories are appearing on the nation's markets, and every month you'll find them described in Popular Mechanics. For additional information about these products, write to Bureau of Information, Popular Mechanics, 200 East Ontario Street, Chicago 11



UNCLE SAM has gone native! The famous Everglades—the southernmost tip of Florida which includes the only tropical jungle within the United States—became the nation's 28th national park upon its dedication by President Truman

last December. This area of untamed beauty, abundant with wildlife and tropical growth, may become as famous a mecca for travel-minded Americans as Yellowstone National Park.

Included within the park boundaries are 454,400 acres of dense jungle, prairie marshland, countless islands and peninsulas crisscrossed by a maze of streams and waterways. There is only one road through the area. To see the wild regions, the giant rookeries of rare birds, visitors will travel by boat or hike along jungle trails.

The aim of the park staff is to maintain the 'Glades as a wilderness and to keep the wildlife undisturbed in its natural sur-

roundings. For that reason road building will be kept to a minimum.

But you'll be able to see the park on conducted tours by boat and on foot. Towers will be constructed to give you an eagle-eye view of the rookeries abounding in rare and odd-looking birds. You can drop a line into the rivers of the 'Glades, where more than 700 varieties of tropical fish abound. Ample fishing facilities will be available within a short time.

At present the 'Glades park is the eighth largest of the chain of national parks. But the park project—including lands expected to be added eventually—covers 2200 square miles. If this outlying land is obtained, the park will be second in size only to Yellowstone within the United States.

Most national parks feature geological phenomena such as the geysers of Yellowstone. The 'Glades will attract visitors through tropical growth and abundant wildlife.

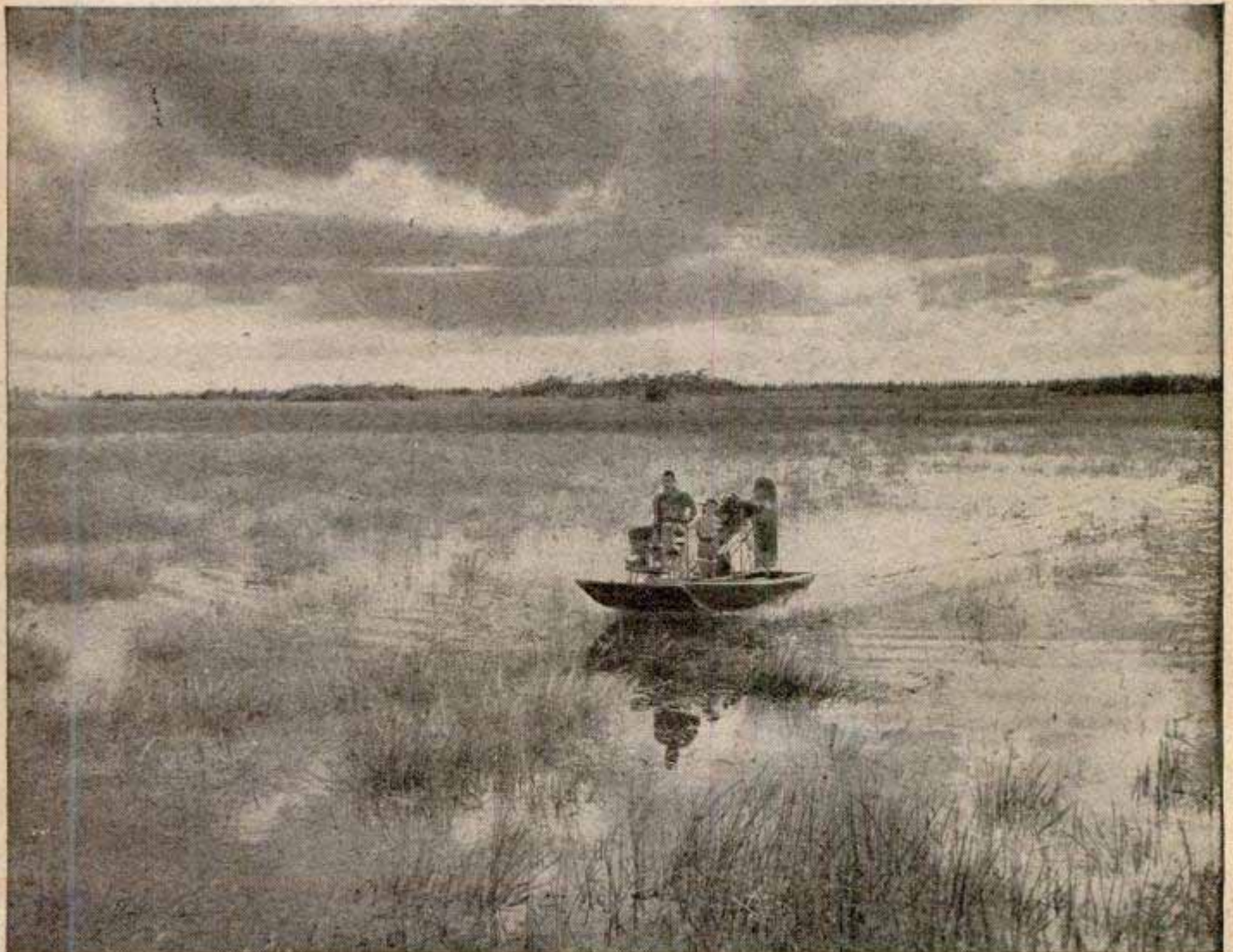
The vast Everglades prairie is a sea of saw grass standing head-high and dotted with "hammocks" or groves of tropical trees rising out of the marshes like islands. At the mouth of Shark River is the giant

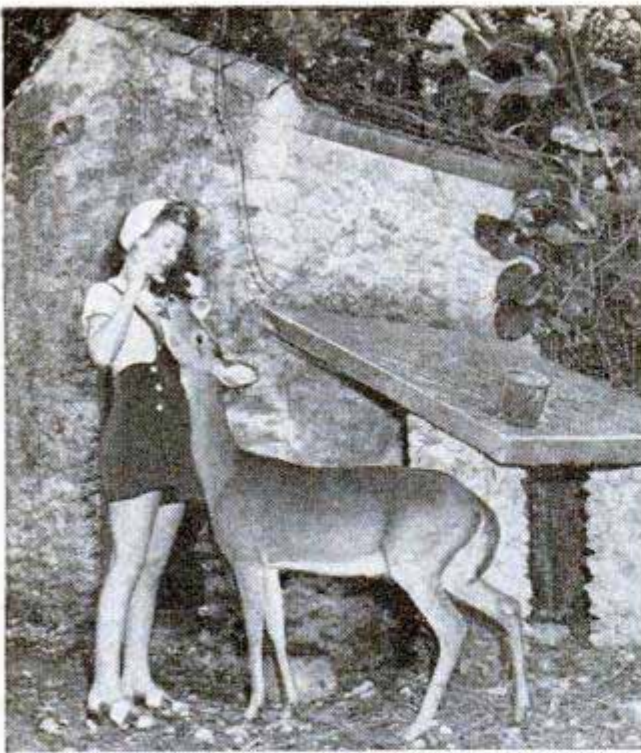
"Hammocks"—groves of trees—stand guard in a sunset over Everglades prairie. Prairie is a sea of saw grass

Uncle Sam's Jungle Playground



Riders explore the Everglades under moss-draped cypress trees. Map shows the only road through the national park and top inset shows park's relation to Florida. Below, a power boat is a popular form of transportation





Wildlife abounds in the new playground. Here a visitor feeds a friendly doe that formerly ran wild

mangrove forest including mangroves towering more than 80 feet, three times the height of most trees of this kind.

Among the strange plants you can see are 84 varieties of orchids, which grow nowhere else in the United States, jungle cacti, ferns with fronds 15 feet long, giant Hippocratea vines with stems as large as your body and strangler vines that wrap themselves around trees, eventually choking them to death. Stands of cypress more

than 1500 years old were full-grown long before Ponce de Leon explored this area.

Birds will be the chief attraction of the 'Glades. This is the only habitat of the great white heron, a pure-white bird standing more than five feet high. Brilliant-feathered tropical birds, pelicans and waterfowl nest throughout the 'Glades.

Unusual forms of animal life include the only specimen of the crocodile within the United States. You'll see alligators in large numbers. Panthers and wildcats are making a comeback in the park area and Florida otters, raccoons and whitetail deer may explore your camping equipment.

Giant manatee, sometimes called sea cows, weighing up to 400 pounds feed on the grasses in the waterways. Sea turtles that tip the scale at 300 pounds nest along the beaches during the summer.

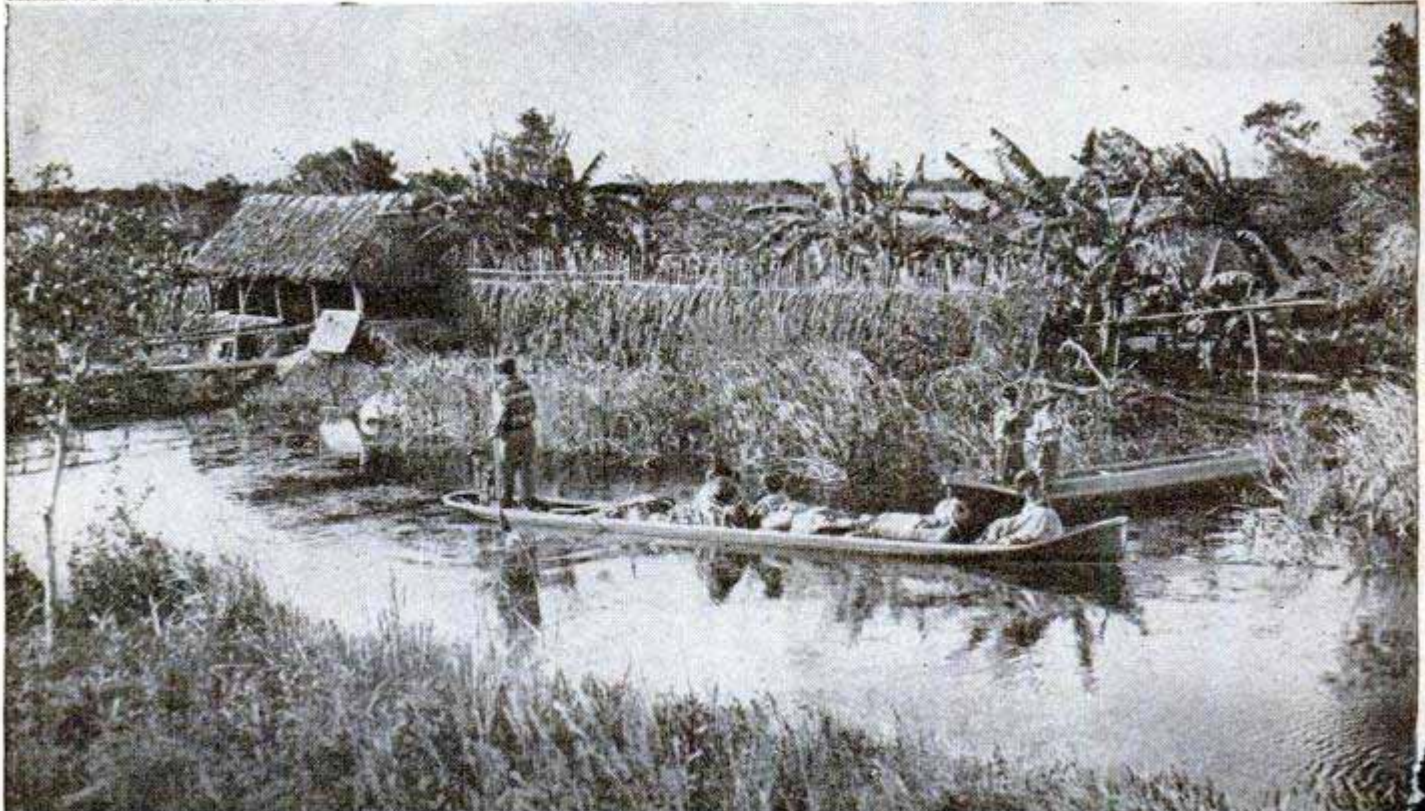
The Seminole Indians once fought a war with the United States and then retreated deep into the Everglades without signing a peace treaty. The park staff plans to establish a Seminole camp accessible to tourists, but no attempt will be made to lure large numbers of Indians back to the park.

At present only one road passes through the area, cutting across the peninsula from Homestead, south of Miami, to Cape Sable. Another road will be built, but its exact route has not yet been decided.

Facilities for tourists are limited at present, but eventually accommodations will be available. There'll be museums, roadside displays and lectures in addition to the escorted tours.

In the heart of the Everglades a Seminole Indian poles his dugout along waterway toward his thatched hut

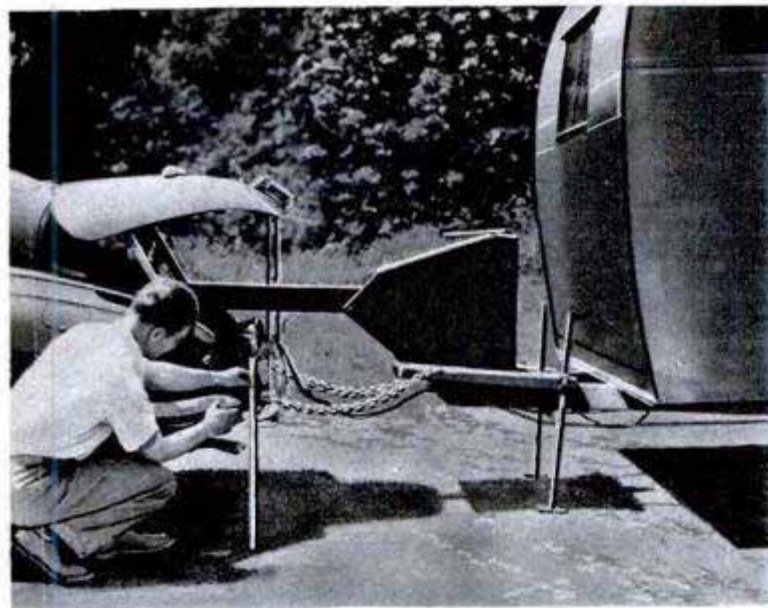
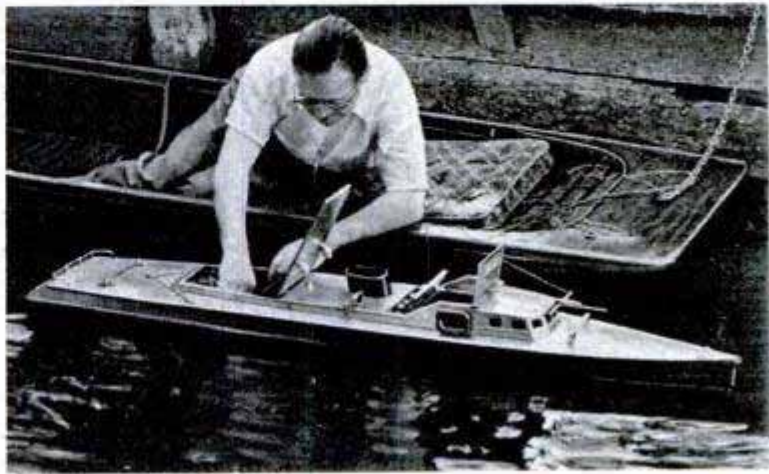
Miami News Bureau photos





Model Steamer Tows Boat

Despite the gasoline shortage, one British boating enthusiast has discovered a way to eliminate the labor of rowing. A model builder, A. E. Squire, tows his boat with a steam-driven model of a British mine layer. Kerosene-fired, the twin-cylinder engine does 3000 r.p.m., and pulls the boat upstream without difficulty.



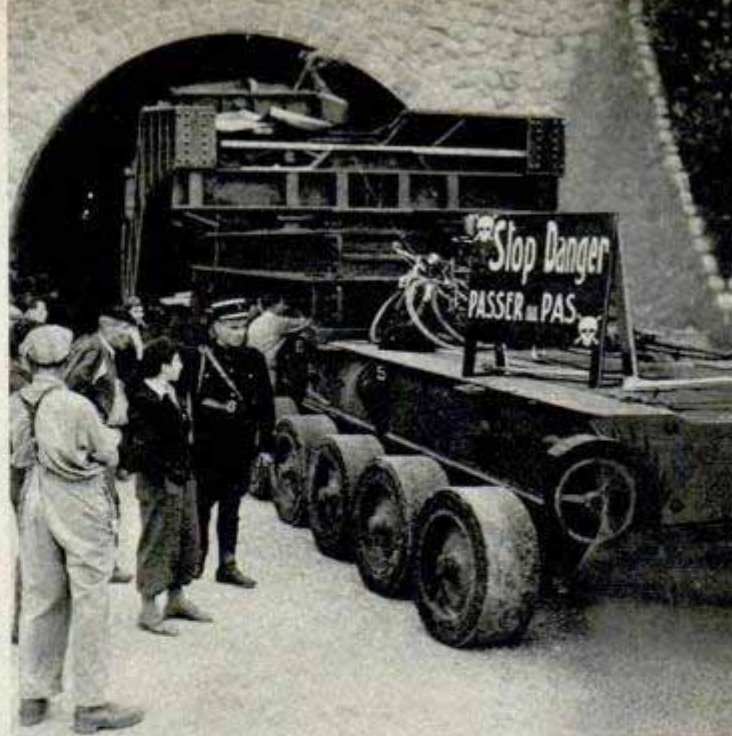
Trailer Hitch Fits in Trunk To Place Weight Over Axle

Attached directly above the rear axle, a trailer hitch moves the load forward to eliminate the need for dolly wheels, helper springs or oversize tires. Strain is removed from the bumper and rear end of the car. The tongue of the hitch connects with a ball inside the trunk, which is held open by a support when the trailer is used. A housing on the rear of the tongue permits the trailer to turn or back up with the tongue moving only an inch from the center of the trunk. Two adjustable rods support the trailer when parked.

Inflated Rowboat Weighs 62 Pounds

Weighing only 62 pounds, a 10-foot rubber boat has three independent air compartments and is sturdy enough for use with a five-horsepower outboard motor. Deflated, the boat folds into a carrying case about the size of a suitcase. The floor, a separate compartment, provides a cushion of air between the occupants and the cold water.



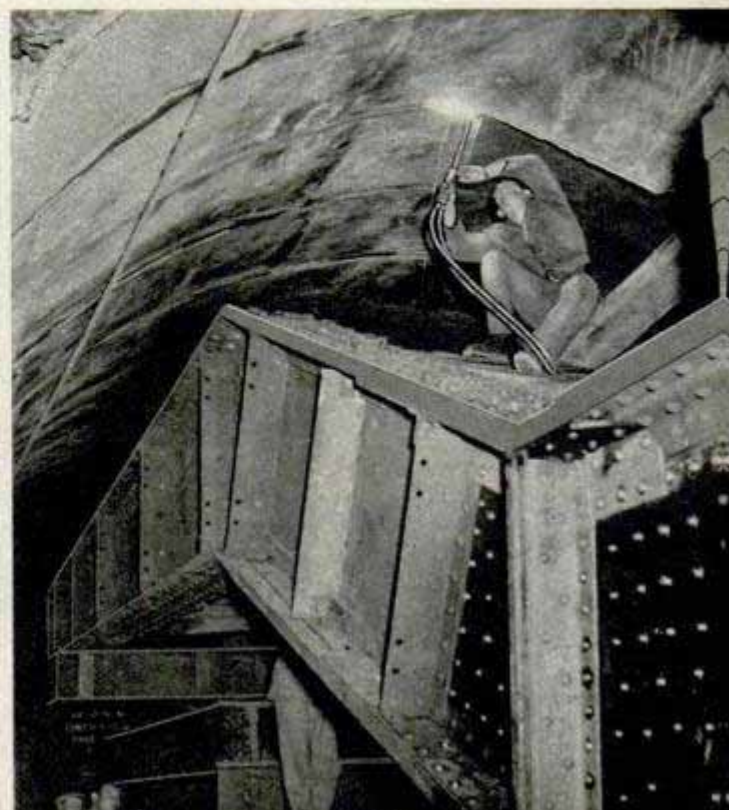


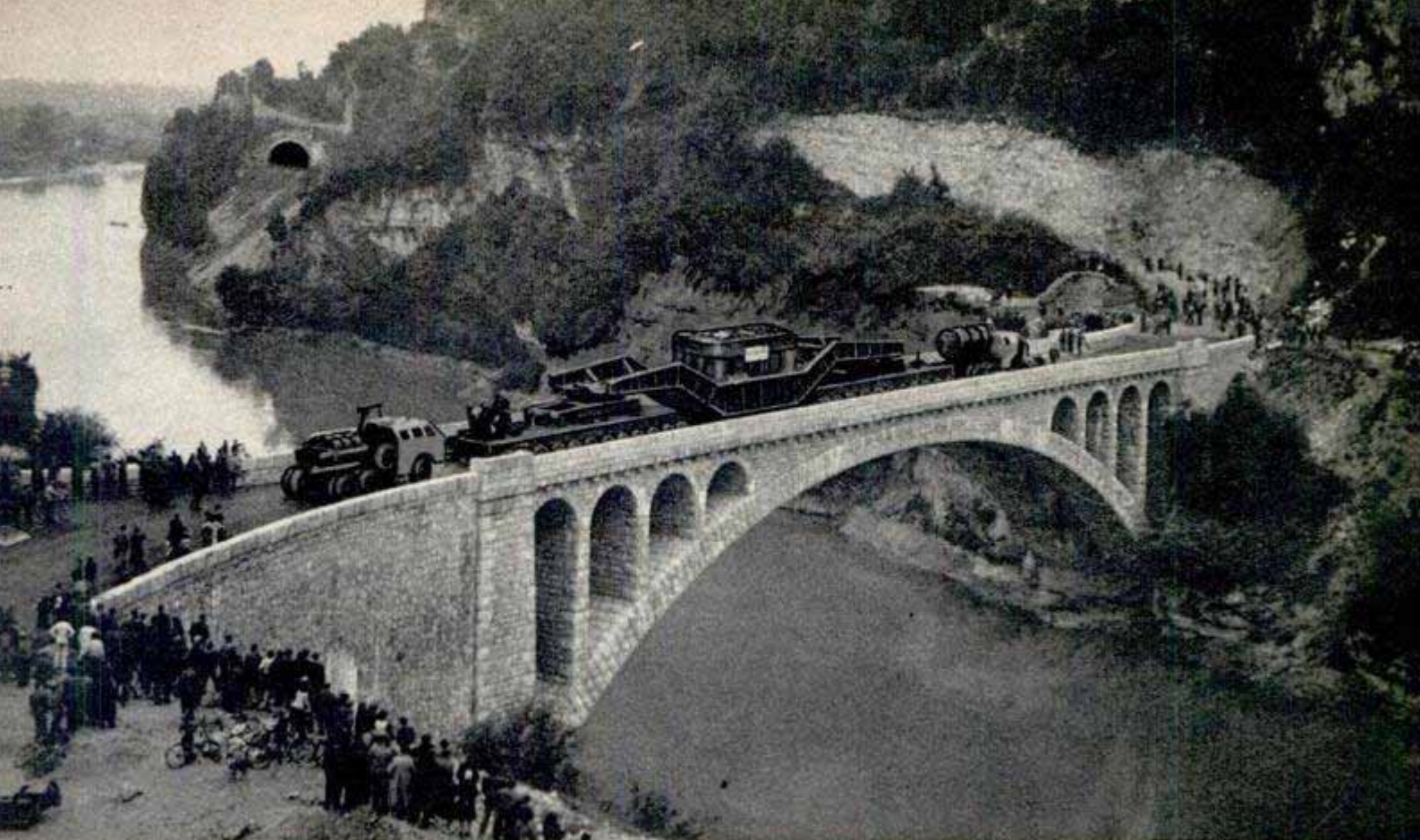
It took the crew 25 hours to inch the big generator through this mile-long tunnel on its way to the dam

Moving a Giant

Weighing 140 tons, a giant 70,000-kilowatt generator built by the French for the Genissiat dam was moved from the factory to the dam along a route that provided minimum clearances in many places. Two former German tank trailers plus two powerful tractors were used to transport the tremendous machine. Installation was completed six months ahead of schedule.

← With its huge load, the long vehicle stretches about a city block. Below, metal lining plates in the tunnel were removed to get necessary clearance





The tremendous weight caused this single-span bridge across the Rhone to sag only a fraction of an inch. With only one inch of clearance in this narrow street at Yenne, the expert drivers got the huge generator through without damage. A drainpipe on one of the houses was the only thing that was removed by the crew.



CALL AIRCRAFT CO.
AFTON, WYOMING

Even in a snowplane, snowshoes are handy to have with you. Toothed bar under body is used for braking



Windjammers of the Snowdrifts

BARKING HUSKIES and cries of "Mush" soon may be heard only in movies as the mechanical windjammers of the snowdrifts invade the Northwest.

The invaders are three-legged, insect-like snowplanes that skim over deep snow on broad skis at speeds that make dog teams look like sluggish glaciers. Called snowplanes, snowmobiles, snowcars, skeeters and other names, the windjammers look like wingless aircraft that, like the kiwi, run swiftly but never fly.

Although windjammers are not new in principle, it took the lightweight, small airplane engine to bring weights down to a low pound-per-horsepower ratio and provide pow-

er to skim through heavy snow.

When the snow is right, anything will skid over it, but plenty of power and little weight are indispensable for "planing" under bad conditions.

Western ranchers have found in the windjammer a solution to winter transportation problems. Instead of hibernating through the snowbound winter months,

At the end of the plowed road mail is transferred from the truck to a waiting snowplane





Rough country like this is as good as a highway for the lightweight windjammers of the snow

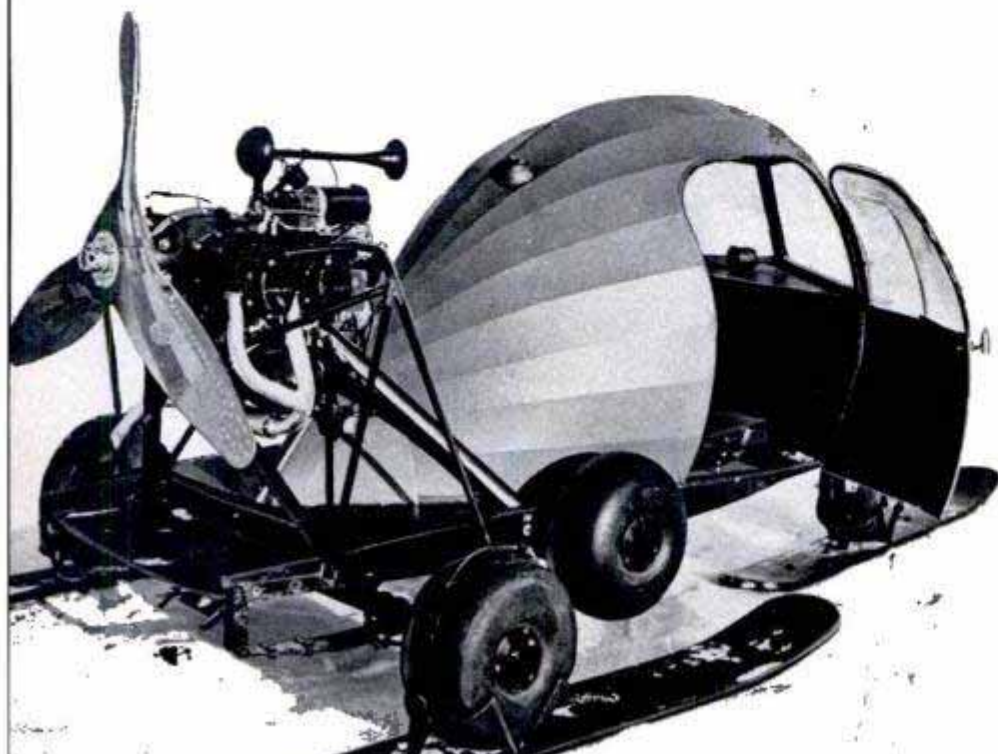
they climb into a snowplane and speed over the snow as fast as they travel in summer on gravel roads.

Star-route mail carriers once used saddle horses and relays of teams and sleds to cover as little as 35 miles a day. That made deliveries slow through the winter. Now they use snowplanes and the mail goes through quickly all year 'round.

But at times windjammers serve more exciting purposes than mail-carrying. One day last winter a storm struck without warning in the Snake River Canyon in Wyoming. A forest-service plane, out counting wild game in the trackless snow, was lost between Jackson Hole and Star Valley. The storm made air search impossible and volunteers prepared to snowshoe into the peaks.

Then the windjammers came to the rescue. They went skimming through narrow corridors the length of the canyon and scurried up tributary slopes.

While snowplanes were searching the area, a government trapper, Sam Young, Jr., telephoned into forest-service headquarters that he had located a survivor, alive but unconscious, in the snow. Immediate medical aid



Detachable skis quickly convert wheeled snowplane for travel on snow-covered fields



This 400-pound snowcar carries two people at speeds up to 85 m.p.h.

was needed. Additional snowplanes were called into service. Hauled by truck over open highways to Alpine, they started up the trail to the wreck. Thirty-two miles up the snowbound canyon, one of them picked up the injured man and rushed him to a hospital before morning. Without the speedy windjammer the rescue would have taken several days.

Two well-known manufacturers of snowplanes are Fred Abercrombie of Jackson and Reuel Call of Afton, Wyo. The Call company builds six models carrying from one to six passengers and capable of speeds up to 90 miles an hour.

Dozens of snowplanes have been built in farm blacksmith shops and small ga-

Because of their light weight and wide runners, snowplanes have become a favorite with fishermen for transportation over frozen lakes



rages. They vary widely in appearance and power. The trend now is toward factory-built products ranging in price from \$750 to \$2500. Very popular for deep-snow driving is the two-place CallAir Car, an 85-horsepower model that weighs less than 400 pounds and sails over the snow like a leaf in the wind.

At Jackson, Sheriff Olin Emory has an Abercrombie Snowcar that he uses for mercy errands and law-enforcement. Most ranchers and stockmen live miles from any open road in winter but the sheriff makes his rounds quickly with the snowplane.

Game wardens patrol with them and conservation officials have found them indispensable for the winter task

of counting elk and deer.

Some models have wheels for use on snowless highways. When it's necessary to leave the road for snow-covered trails or fields, detachable skis that fit over the wheels are attached to the versatile vehicles. It takes less than five minutes to change over from wheels to skis.

Although speed depends on terrain, snow and wind conditions, it is not unusual for a snowplane to travel from Swan Valley, Ida., over Teton Pass, 9000 feet high, to Jackson, a distance of 50 miles, in less than two hours. On level roads, some 50-mile trips have taken less than an hour.

Some high-powered units have been clocked at 85 miles an hour on perfect snow in calm air. With a strong tail wind, snowplanes have whipped along at 100 miles an hour. On wheels they will go faster than it is safe to drive them on ordinary roads, but snowplane experts believe that on a course such as the Bonneville Salt Flats they might exceed 125 miles an hour.

Airplane-type throttles and front-ski steering are used in most models. The front ski is mounted off-center to compensate for propeller torque.

The roar of airplane motors and the whirr of spinning propellers may not be as picturesque as the bark of Eskimo dogs, but the Northwest is converting to snowplanes just the same. The windjammers get there—and fast.

Glass "Popcorn" Lightens Plaster

Seven tons of useless weight are eliminated in a seven-room house by the use of a lightweight plaster aggregate instead of sand. The new material is composed of tiny glass globules formed by heating volcanic glass to 2500 degrees Fahrenheit. When subjected to this terrific heat, the raw ore, called perlite, "pops" like corn to form tiny glass spheres. The ore is extracted from a mountain of volcanic glass in central Oregon that contains at least 20 years' supply of the nonmetallic material. After popping, the material weighs only 12 pounds per cubic foot as compared with



Insert shows how "popping" expands and whitens ore for mixing with plaster

sand's weight of 85 pounds per cubic foot. Plaster made with the new aggregate is highly resistant to checking and cracking.

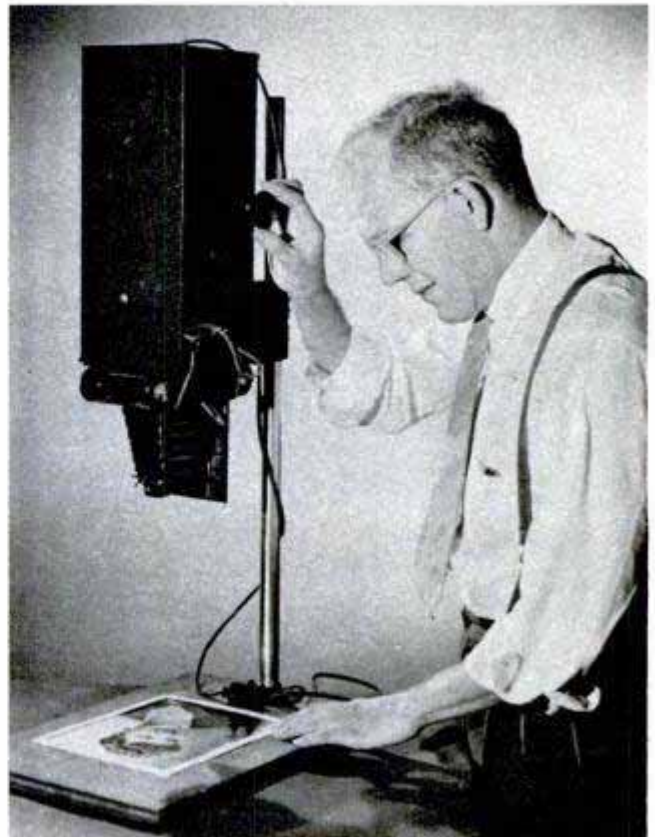


Coiled Wire Springs Form Tires

Cyclists have no worries about punctures when riding on tires made of coiled springs such as those exhibited at the recent Paris Fair. The shortage of rubber tires in France led to the invention of this metallic substitute. Claimed to be as easy-riding as pneumatic tires, the steel tire has long-wearing qualities.

Camera That Took the Pictures Used to Make Enlargements →

Enlargements can be made with the same camera that took the pictures by means of a new enlarger. The enlarger is designed to use the lens and bellows of any camera with a removable back or one that opens 180 degrees. The camera is fastened to the bottom of the lamp house and the film placed in a glass carrier that racks up and down inside the lamp house for focusing. The movable film carrier permits use of fixed-focus equipment such as box cameras. Metal masks to fit popular camera sizes are provided with the enlarger.





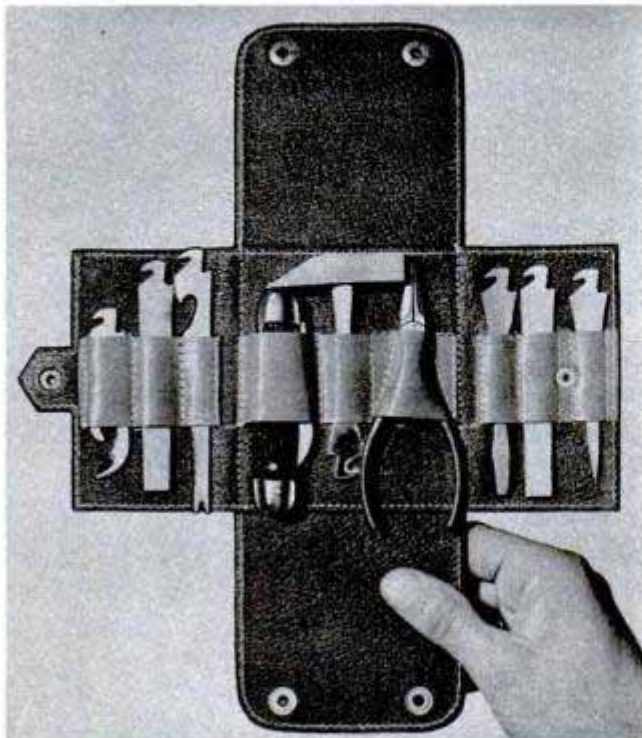
Baby Bottle Warmer for Trains

Mothers traveling with infants have the convenience of warming baby bottles at their seats with bottle warmers provided on Chesapeake and Ohio trains. The warmer is an aluminum block with spaces for the bottle and a hermetically sealed heating unit. The heating unit is dropped into the warmer and another tube placed on top of it which acts as a starter. A chemical action then warms the bottle. The warmer is small enough to be placed on the window sill beside the seat and heats the bottle to 102 degrees in three minutes.



Boom Spray Covers Wide Strip

Spraying several acres a day is possible with a portable sprayer equipped with a wide boom. Constructed at Michigan State College, the sprayer is used to apply 2, 4-D and other concentrates to lawns, pastures and cornfields. A five-gallon hand sprayer, mounted on a garden cultivator, is connected by rubber hose to the boom made of $\frac{1}{8}$ -inch pipe. An automobile gasoline filter in the line prevents clogging of the fan-type nozzles mounted at 18-inch intervals. Nozzles can be adjusted to use as little as six gallons per acre.



Pocket-Size Tool Kit

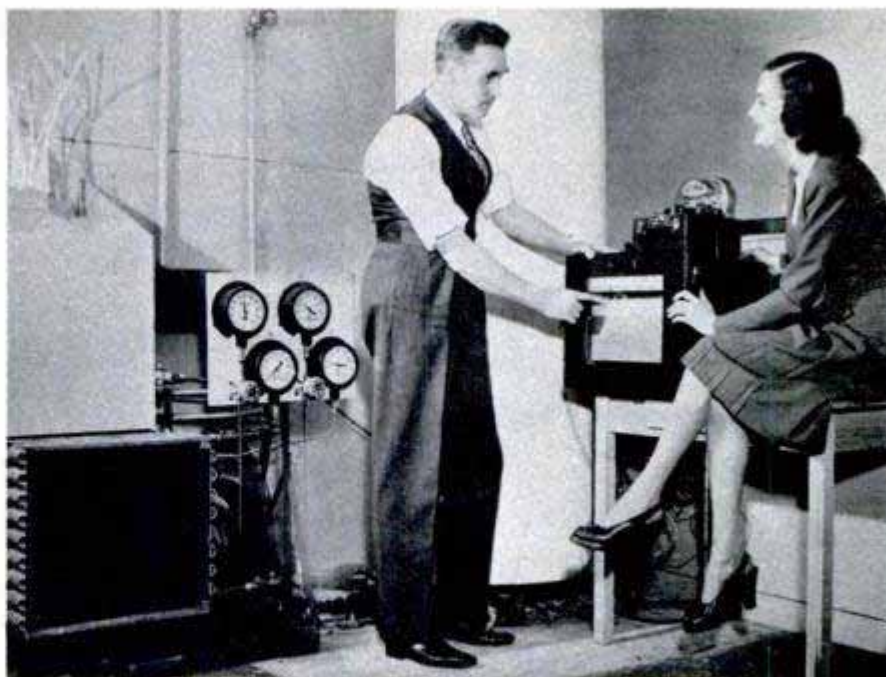
Nine tools are included in a pocket-size tool kit made of cowhide. The tools are jackknife, hammer, combination can opener and cap lifter, awl, chisel, screwdriver, flat file, scaler, disgorger and pliers. The jackknife serves as the handle for each tool which is equipped with a hook to attach to the knife.

"Toe Gauge" Records Blood Pressure

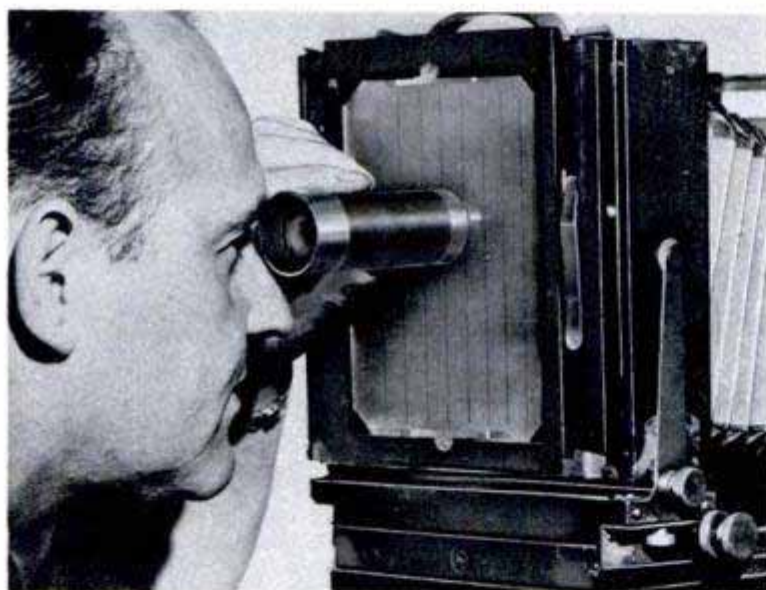
Blood pressure changes sufficient to alter the size of toes and fingers are measured by a newly devised plethysmograph. The patient's toe, or finger, is placed in a small cup which is sealed around that member. As the heart beats, pumping blood into the finger, the finger expands. This forces air out of the cup into a tube and to a recording device. The air "writes" a record of the change in the size of the finger as the blood flows in and out.

Air-Cooling System Provides Hot Water

Warm air in a house provides heat for an experimental water heater that may, after further development, air condition the entire house. Designed by J. C. Sharp of Hotpoint, Inc., the "heat pump," which is not yet perfected, reverses the function of a refrigerator. Freon, such as used in refrigerators, is piped into a coil in the room where it absorbs heat, becomes warm and evaporates, cooling and dehumidifying the room at the same time. The Freon, now a gas, is compressed by an electric pump further increasing its temperature. Pumped through coils in the water heater, the gas



releases its heat to the water and is condensed. A liquid again, the Freon returns to the room coil and the cycle is repeated.



Magnifier Aids Focusing Of Ground-Glass Camera

Precise focusing without eye-strain is possible with a magnifying tube designed for use with any camera using ground-glass focusing. Placed against the ground glass, the fixed-focus magnifier brings the reflex image into sharp relief making critical focusing easy. The coated lens produces 3.5 magnification and can be used also in photomicrography and reflex focusing for enlarging. A flannel carrying pouch is provided with the tube to protect its exterior which is highly polished.

Guard on Posthole Digger Pushes Fence Out of Way

Attached to a tractor-operated posthole digger is a guard which holds fencing out of the way while the operator digs holes in a fence row. Other features are a cone clutch control to increase digging speed and forward and backward adjustments for hillside and angle digging and for such jobs as setting out trees, digging drainage ditches and for foundation digging.

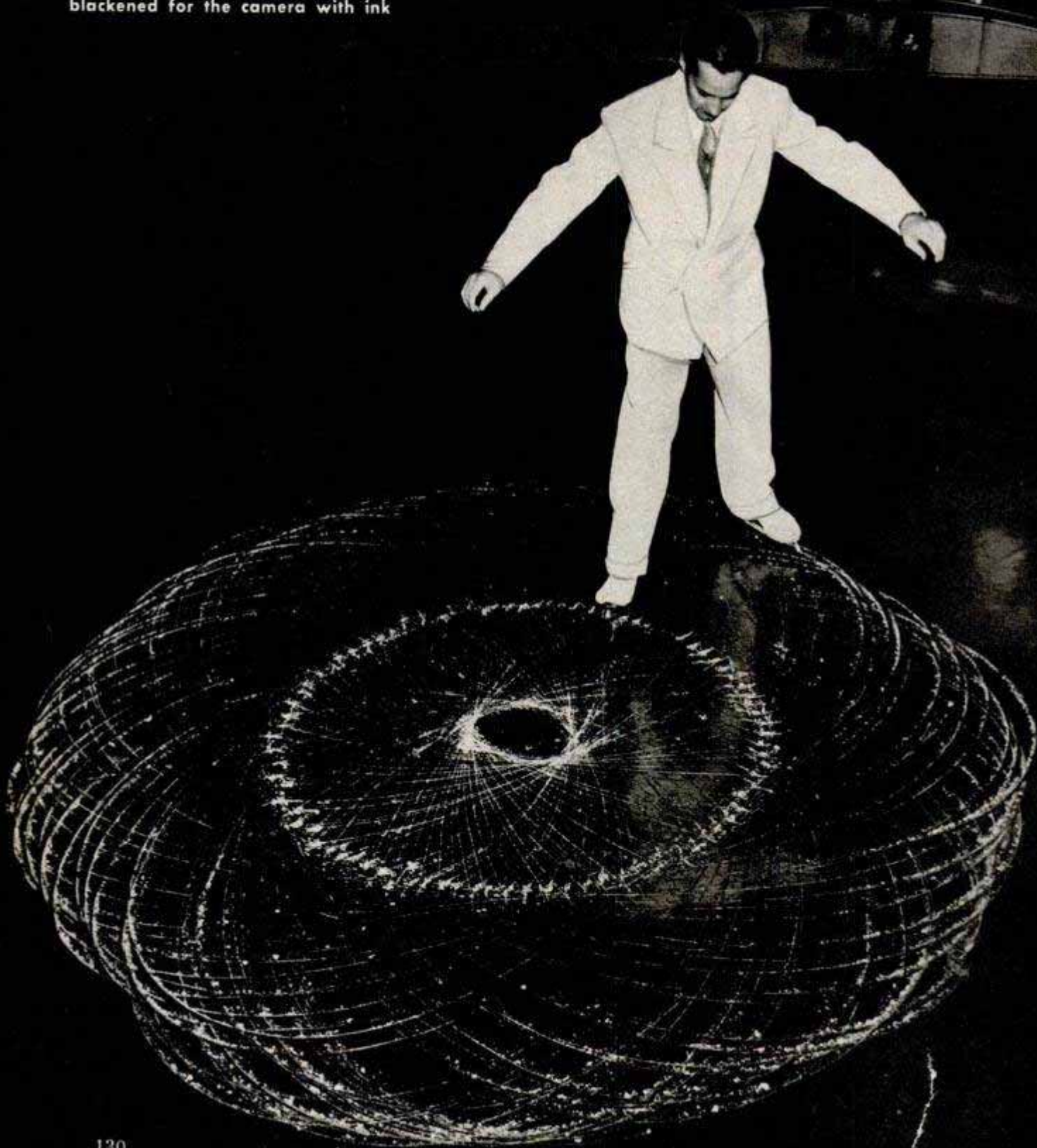


It would take 40 "grain-of-wheat" lamps, used by surgeons in exploring body cavities, to produce as much light as a match.

Cut a Figure on Ice

By Roy Shipstad

The author, of Ice Follies fame, executes a "ball of twine" on ice blackened for the camera with ink



ICE SKATING'S biggest thrill, I believe, comes when you discover how easy it is to glide and swoop and turn on the ice, doing all sorts of stunts that are impossible on dry land.

What surprises you most is that you haven't had to learn anything really new; you are merely taking advantage of your natural sense of balance. The hardest part comes later when you strive for perfection, rehearsing a certain figure over and over again until you can do it exactly the same each time.

The first thing you need for good control is a pair of figure skates. These are hollow ground so that each blade has two edges. Their advantage is that when you use both edges you travel straight ahead and when you use one edge you curve in its direction. The teeth on the toe of the figure skate allow you to retard your speed when moving backward, to dig into the ice preparatory to a jump, to do scratch spins, and other kinds of toe work.

In the following paragraphs, remember that "right outside forward edge" means that you are to use the right foot, the outside edge of that blade, and that you are moving forward. "Left inside backward edge" means that you are moving backward on the inside edge of the left blade.

One of the easiest positions, after you have gained enough confidence to glide on one foot, is the so-called spiral. In this you move across the ice with arms outstretched and one leg stretched out behind. It may be done on either edge of either foot. Arch your back and raise one leg out behind while you are moving across the ice. This forces your body forward. Stretch your arms out at the same time and you are in the correct position. If you use the inside edge of the right foot you will travel in a spiral to the left, if you are using the right outside edge you spiral toward the right.

It is important in all skating to maintain a natural upright position except when you are trying such a posture as the spiral or are crouching for speed. You can compensate for most body motions with knee action. Always carry your shoulders level. If you don't, you will be off balance.

The Figure 8 is one of the basic school figures and when you learn to do it properly you'll have a good basis for more complicated maneuvers. The 8 consists of two lobes or circles, one of which you make with your right foot, the second with your left.

After selecting a spot on the ice that is to be the center of your Figure 8,



Mr. and Mrs. Harris Legg cut a fancy figure on stilts; note how steel brace from skate is secured to foreleg. Below, twin skaters shackled foot-to-foot and at wrists





It's the skate edge that counts when cutting a perfect Figure 8. Below, Harris Legg sprays cloud of ice in coming to stop after leap



strike out with a right outside forward edge. Your arms are stretched out and your shoulders and hips are turned away from the circle you are to make. As you glide, slowly rotate your shoulders and hips and gradually bring your unemployed leg forward. This causes you to move in a circle that should bring you back to your starting point. Here you strike out again, this time on the left outer edge. This edge turns you away from the first lobe and starts your second lobe. Complete it by rotating your body the same as in the first lobe. Each lobe should be about 15 feet in diameter.

The 8 sounds easy and it is, but it takes practice. Here are a few tips: your weight should be in the center of the skate or a shade back of center. Don't change your balance or raise or bend your knee during a lobe as this will make you wobble and spoil the pattern. It's well to have brought your arms, shoulders and hips entirely around by the time you complete the first lobe so that they can start your body in the opposite direction for the second lobe.

In all, there are four different ways to make a Figure 8. The above description uses the right and left outer edges. You can do the same figure with the inner edges and you can also do it with each edge while moving backward. You start a backward glide by pushing off with the free foot.

All figures such as the 8 must be traced three times in competitive skating and the judges watch to see how closely you can make your tracings look like one line. They watch you, too, for style and grace.

After you have mastered the 8 you should practice the turn used in making the Figure 3. The start is just as if you were going to make a Figure 8, using the right or left outside forward edge, depending on whether you are starting at the top or bottom of the 3. Your shoulders and hips come around more rap-

idly and you have rotated your body to the right (or left) by the time the lobe is half complete. This allows you to turn your skate on the ice so that you are traveling backward. (See illustration.) Shift to the inner edge and you continue to travel in an arc that will complete the lobe. Upon completing the first 3, strike out again, make the 3 turn, and finish the figure to make a pair of 3s somewhat resembling a Figure 8.

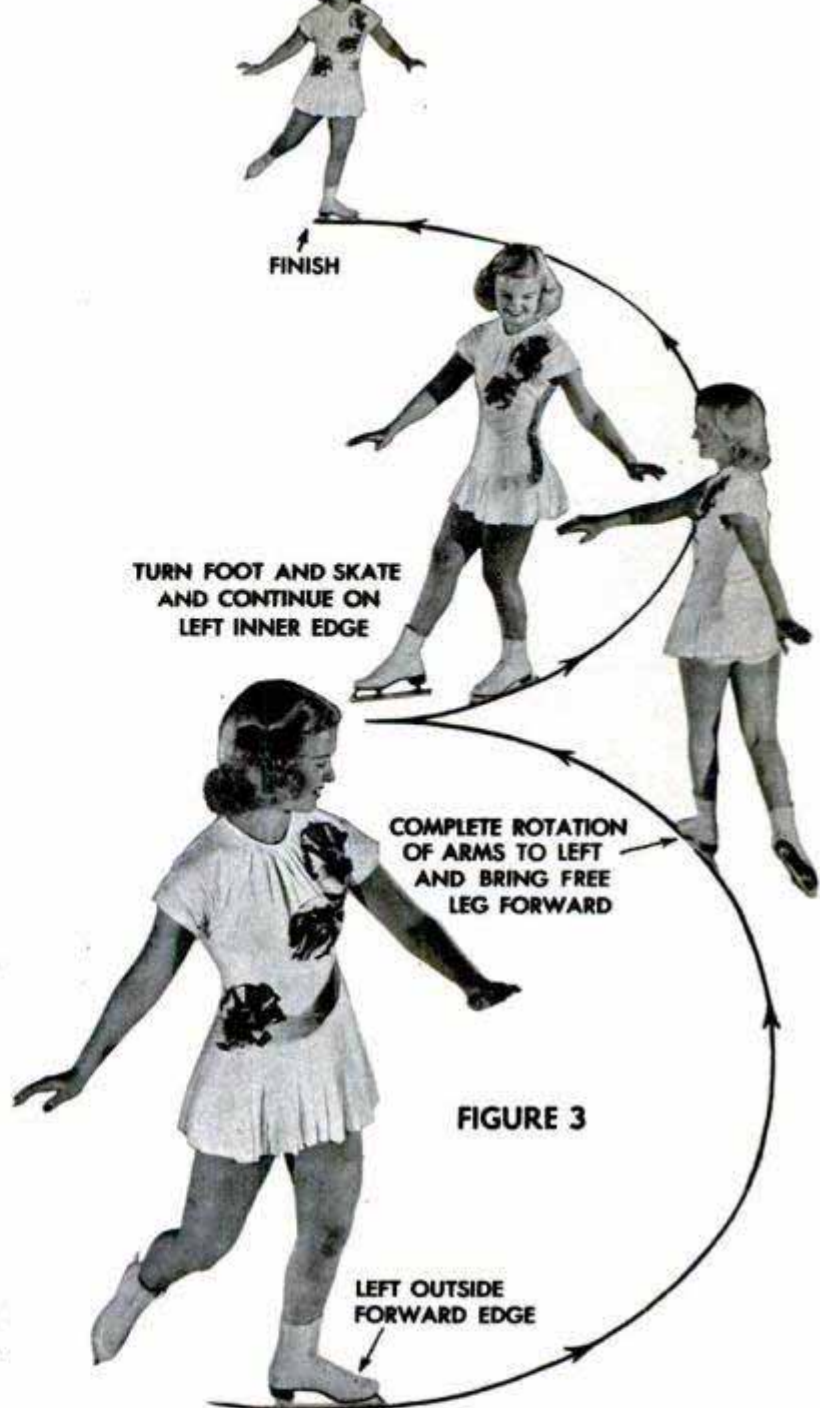
It's best to take lessons in figure skating and you can learn a good deal just by watching accomplished figure skaters on the ice. Notice how they control the patterns they make by the way they turn their arms and shoulders. Most people who take lessons are interested mainly in learning to skate to music in couples as in ballroom dancing, but if you learn how to use your edges and how to make 3 turns you can soon learn to skate to music.

One spectacular stunt is to spin like a top on the ice. It's not as hard as it looks. Try it first with both feet, standing flat-footed and a bit pigeon-toed. With your arms extended wide, twist your arms and shoulders to one side and then whirl them around in the opposite direction. This starts you spinning. When you begin to slow down, draw your arms in closer to your body and to your surprise you will pick up speed. Try lifting one foot and spinning on the other, rising slightly on your toe to cut down friction.

Bringing your arms in close to your body is the secret of a high-speed spin. You can start slowly with your arms outstretched, bring them in for speed, then extend them again to slow down. I've made 85 revolutions from a standing start simply by the control that the arms provide.

To do a sit spin, start to spin on one leg and then bend your knee and extend the unemployed leg, keeping the knees far apart. Pull the unemployed leg in slowly when you want more speed. Another way to get speed and revolutions is to start with your head tipped forward and slowly bring it up to its usual position. It's best to take a number of steps in the opposite direction when finishing a spin, to recover from your natural dizziness.

One simple trick is to glide across the ice from a standing start without any apparent movement of the body. Start with your feet close together and with your toes pointed out only a few degrees. Exert pressure as if you were trying to push your feet apart. The run of the blades keeps your feet from spreading and so you begin to move ahead, almost, it seems, by magic. An expert skater can glide 20 feet or more while the distance between his feet gradually widens to six or seven inches.



Half forward, half backward—the graceful Figure 3. Below, Evelyn Chandler does gliding “one-foot crouch”





Left, like a human top, Geraldine Huesing of Chicago Figure Skating Club performs difficult layback spin. Right, twin skaters show how beginner at left can be supported on the ice with partner's arm under her elbow

Being able to come to an abrupt stop from high speed is something that everyone should learn. The easiest way to stop is simply to turn your back foot at right angles and hold the blade down flat, making it skid sideways and bringing you to a slow stop. You will stop much faster by turning both feet sideways and keeping them parallel, bending your knees at the same time to keep your balance. Both

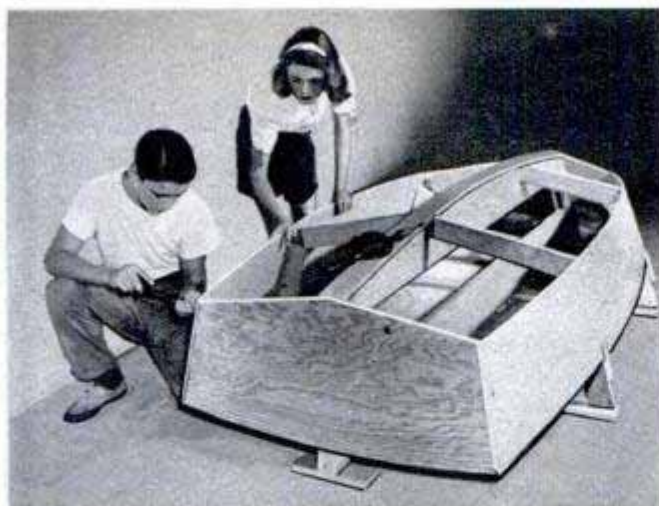
blades skid across the ice and you come to a stop in less than a foot. Expert skaters send the ice flying when they come to an abrupt stop by jumping at high speed and then landing with their feet turned sideways. The blades dig in and skid and the ice flies up in a cloud.

Everyone can expect a fall on the ice now and then. Even an experienced skater may take numerous falls while rehearsing a new stunt but he is rarely hurt. One of the first things to learn is to go limp when you lose your balance and allow your whole body to absorb the shock. If you relax when you fall it won't hurt nearly as much as you expected.

Boots that fit properly are extremely important. A skater should wear medium-weight socks and should lace each boot not too tightly, but firmly enough so that it feels like part of the foot. Loose boots cause spills and sprained ankles. Many more people would have confidence on the ice if they were careful to be properly fitted.

Roy Shipstad goes into his famed spin on right foot which is lifted as he starts whirl. Note the arm position





Top, your basement becomes a boat yard with the easy-to-assemble kit. Left, the plywood boat is roomy and has ample freeboard for safety. Right, an additional kit can be used to convert it into a sailing dinghy.

Eight-Foot Plywood Boat Is Built From Precut Kit

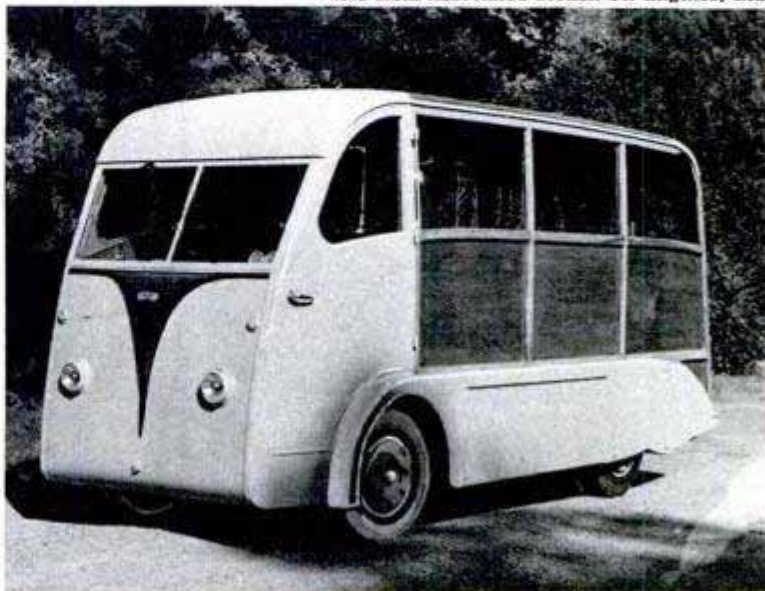
All construction materials for building a small boat are packaged in a kit with the major parts pre-cut from plywood. Only a screwdriver, drill and plane are needed to assemble the boat, which measures eight feet long and has a 48-inch beam and 16-inch inside depth. The dinghy is built on

construction frames that are supplied with the kit. Weighing only 65 pounds, it will accommodate a two-horsepower motor and can be converted to a sailboat with a conversion kit that includes a mast, boom, flooring, tiller, centerboard and rudder. The sides and bottom are $\frac{1}{4}$ -inch plywood.

British Station Wagon Runs at Low Cost on Electricity

Operated for about one cent a mile, a British station wagon is powered by an electric motor and seats 12 adults. Designed for short trips, the vehicle cruises at 20 miles an hour and goes 60 miles on a battery charge. As a school bus, the station wagon seats 20 children. An unusual electrical circuit provides a gearless shift system. Two strokes of the control pedal are necessary to accelerate from a stop to full speed. The first stroke, with the two halves of the battery in parallel, draws only half the full voltage. The second stroke, connecting the battery in series, draws full voltage to provide maximum speed.

Photo from Associated British Oil Engines, Ltd.



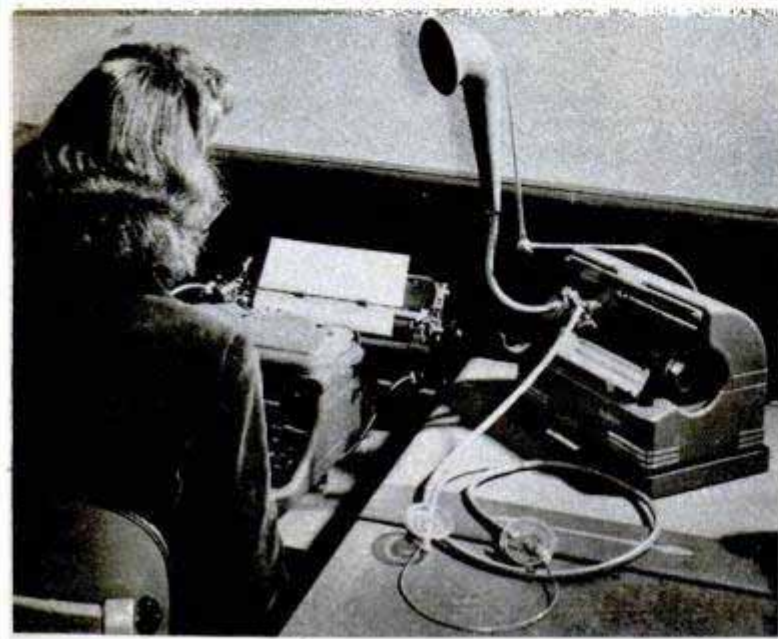


Foot Massaged by Rubber Ball

Tired feet are massaged by a hand-operated machine that rolls a rubber ball gently back and forth under the arch of the foot. The metal base has an adjustable heel rest and a wide strap holds the toes in the proper position during the treatment. Moving the handle back and forth rolls the ball across the bottom of the foot.

Loud-Speaker for Dictating Machine

By the use of a loud-speaker attachment, secretaries working with dictating machines do not need earphones while transcribing dictation. Loud enough to be heard two or three feet away, the speaker has an adjustable volume control. The earphones can be used when material of a confidential nature is being typed.

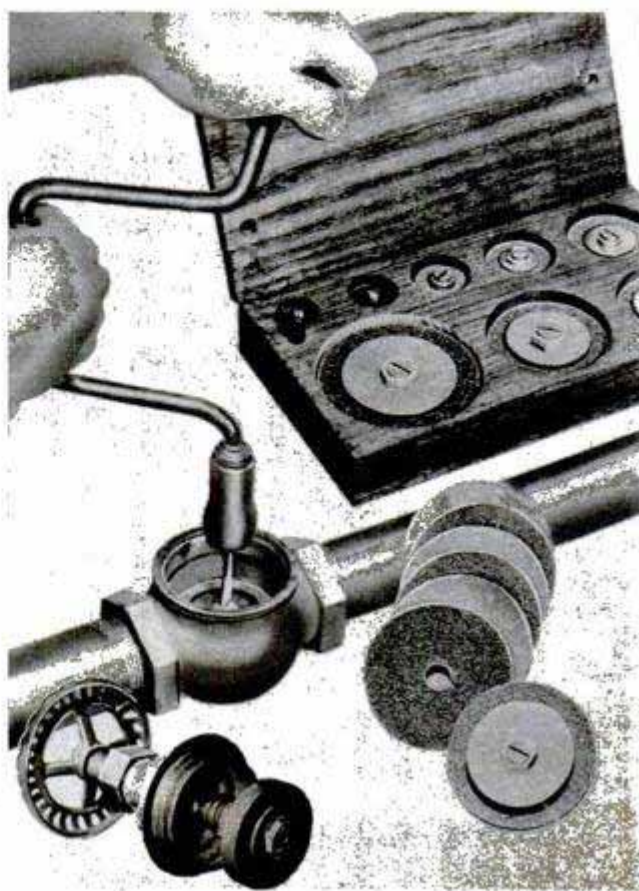


Plastic Bag Keeps Brush Soft

Paintbrushes can be put away without cleaning when placed inside an airtight Pliofilm container. An elastic band at the top of the container keeps the air from drying paint left on the bristles and provides a means of hanging the brushes. Brushes are kept soft and ready for use.

Disks Renew Worn Valve Seats

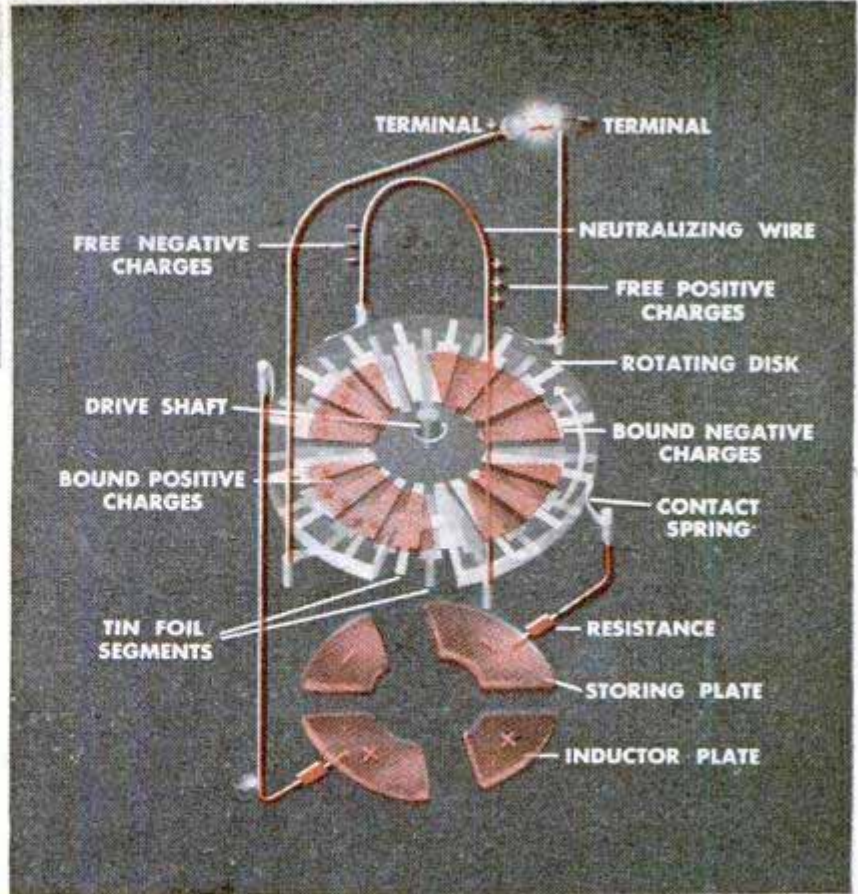
Valve seats are ground and polished quickly with a reseating tool that uses aluminum-oxide disks mounted on each side of a thin steel body. The disks are rotated by any brace equipped with a screwdriver bit. One side of the tool is a coarse abrasive for removing defects; the other is a polishing abrasive. The tools are packed in a kit that includes eight sizes.



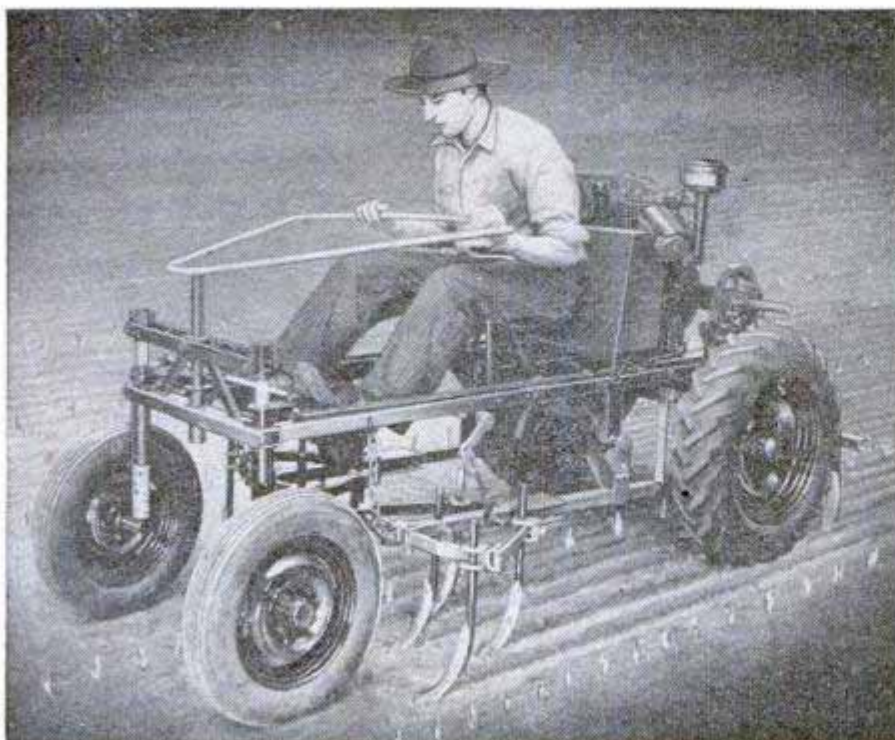


Midget Generator Produces 12,000 Volts

Weighing less than a pound, a high-voltage generator based on the principle of the Wimshurst induction generator produces 12,000 volts direct current from a six-volt battery. Designed in Germany, the new generator operates on the basic theory that unlike charges attract, like charges repel. The pocket-sized generator has a diameter of 4½ inches. A larger model delivers 30,000 volts and there is apparently no limit to the size that can be built to operate on the Wimshurst principle. Two layers of tin-foil strips are embedded in a plastic rotary disk and act alternately as inductors and carriers. Beneath the rotor are four aluminum plates, two of which are inductor plates and two storing plates. Directly above the rotor are four similar plates. A bound positive charge is induced on the foil as it passes over the negative inductor plate and free negative charges escape along a neu-



tralizing wire. The positive charge is shared with the storage plate through a contact spring connection. Just before it passes beyond the field of the storing plate, the foil touches a second spring leading to the terminal. The positive charge on the storing plate kicks the now unbound positive charge on the foil onto the terminal. A similar reaction is used to charge the negative terminal. The device may have important consequences in the problem of long-distance power transmission.



Fuel-Saving Tractor Has Engine in Rear

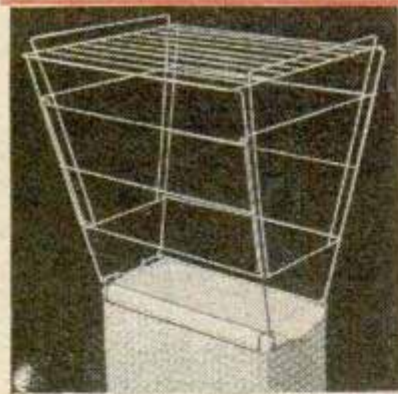
With the motor mounted in the rear, a lightweight tractor allows unobstructed vision from the driver's seat. The 1000-pound tractor has a triangular steering bar instead of the conventional wheel and it provides a crop clearance of 22 inches. Knee-action wheels keep the tractor level on uneven ground. For use between rows, the rear wheels can be adjusted for any width between 36 and 46 inches. The small, six-horsepower engine has a low fuel consumption.



WHAT'S NEW *For Your Home*

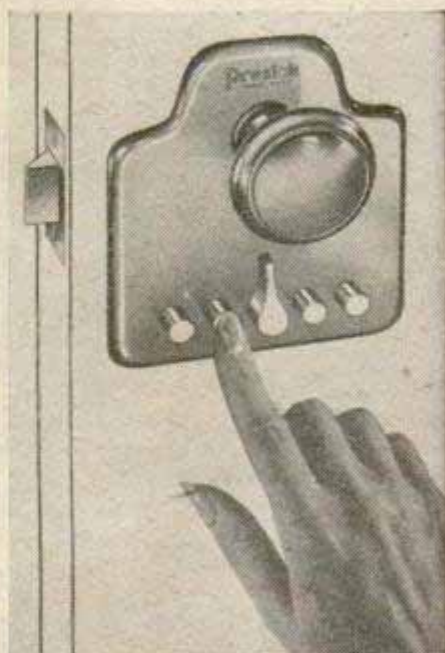
A four-page "shopping section"
dedicated to modern homemakers

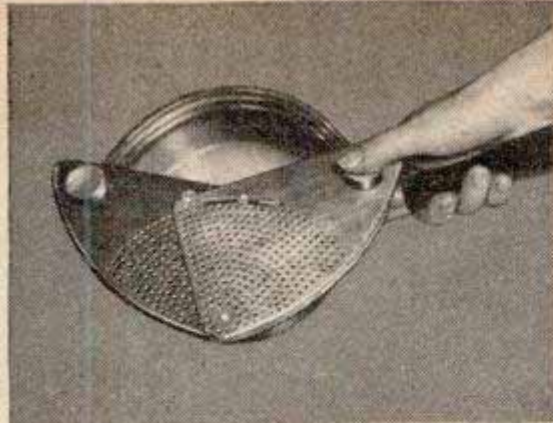
SPLASHLESS WATER pours out of any faucet when an aerator is used to add millions of air bubbles to the liquid. The foamy water clings to all surfaces without splashing and it lathers rapidly with less soap



FOLDING CLOTHES DRIER provides 42 feet of drying space. Although designed to be used atop an electric heater, it can be set up by itself

KEYLESS DOOR LOCK opens when the correct combination is tapped out on push buttons. Lever below the knob is turned to lock the door

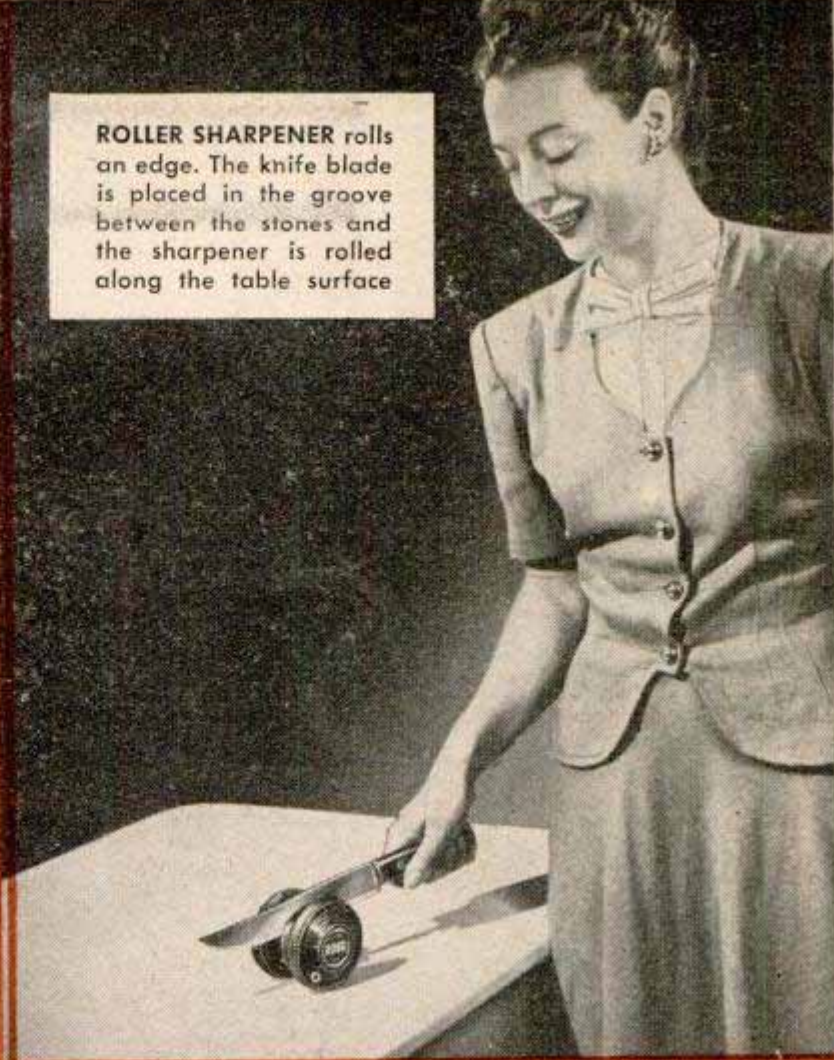




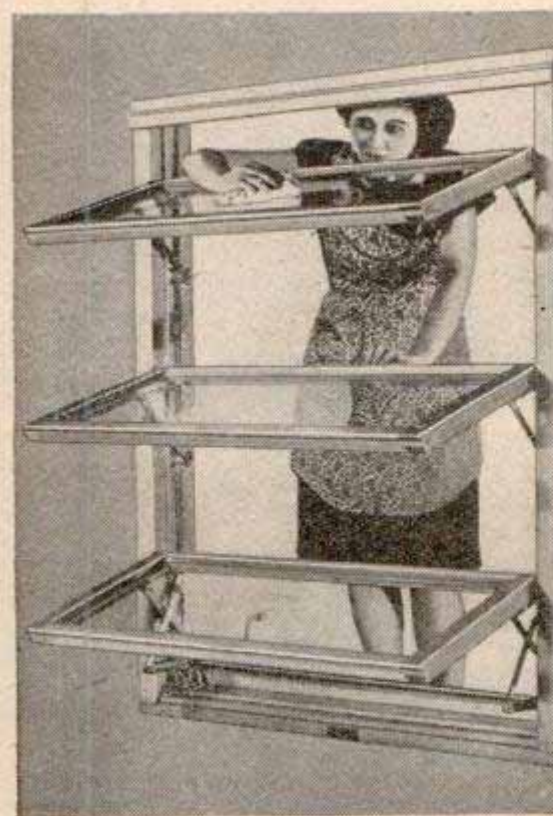
FOLDING STRAINER fits almost any pan. Two nonburn knobs are used to clamp it in place for pouring



ROLLER SHARPENER rolls an edge. The knife blade is placed in the groove between the stones and the sharpener is rolled along the table surface

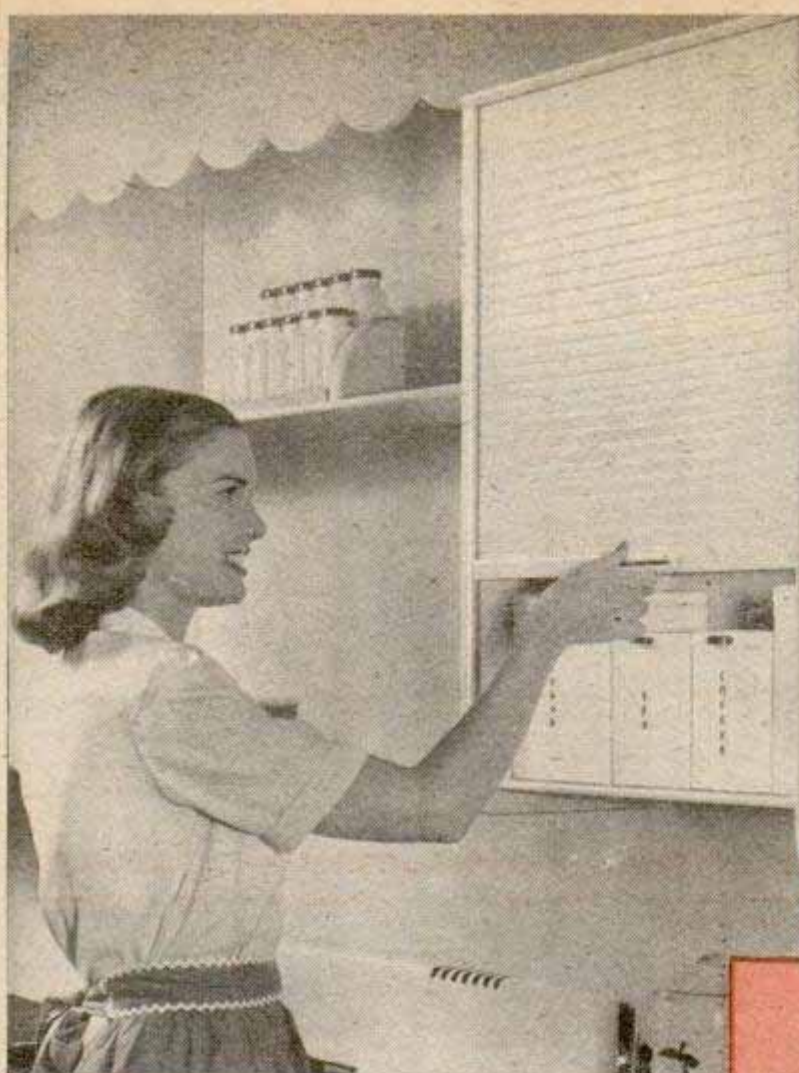


NO-DRAFT WINDOWS are washed on both sides from within house. Crank-operated, all sections are locked securely at any position

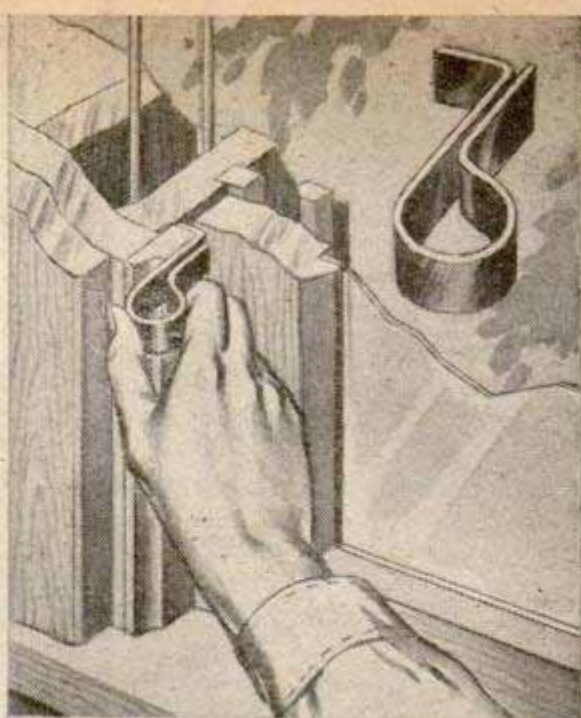


STORAGE CABINETS convert an ordinary studio couch into a comfortable sofa and also provide convenient storage space. Made of plywood, the cabinets are attached to the wall. The tops of the cabinets form an attractive shelf for books and knickknacks





ROLLAWAY DOORS for kitchen cabinets end the danger of banging your head on swinging doors. Opened and closed easily, doors are made of colorful Tenite plastic



ANTI-RATTLER for noisy windows can be installed quickly. Pressing the window against the frame, it also cuts drafts

WHAT'S NEW *For Your Home*

Continued from preceding page



DISPOSABLE BAGS for garbage fit into a step-on holder. When filled, the waxed, odorproof bag is removed and discarded

NONSLIP PLUG assures good contact and cannot be pulled out accidentally. The plunger forces wedges along the prongs





↓ **BINDING TAPE** to prevent raveling of rug edges is applied by heat from an iron. No stitching is required and the tape is available in many colors



↑ **VENETIAN-BLIND CLEANER** not only washes slats, but waxes them at the same time. Two rubber sponges clean both sides of the slat and also apply the wax

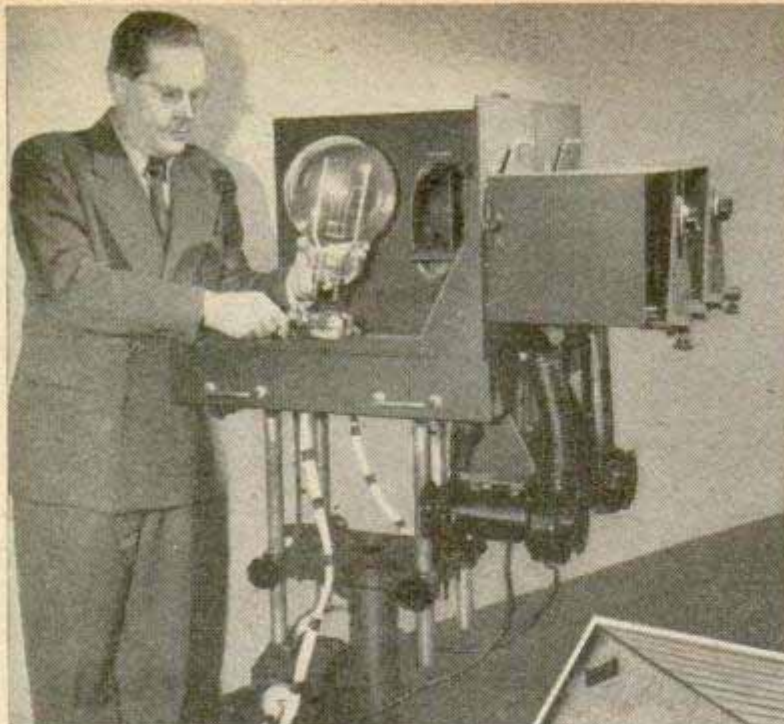


↓ **ADJUSTABLE SOCK DRIER** fits all sock sizes from 9 to 13. The plastic stretcher prevents shrinkage and its smooth surface cannot snag



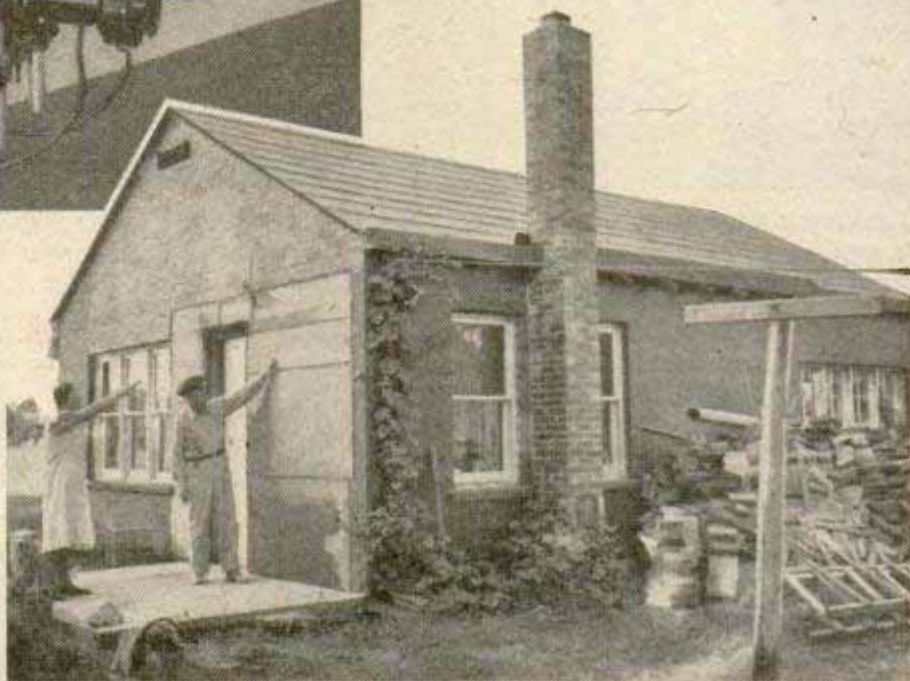
ROLLER SCREEN goes up and down with window. Made of plastic, the screen rolls up inside the nonrust aluminum box attached to the window sill





AIRPORT FLOOD LAMPS are light source of a powerful slide projector that magnifies up to 40 diameters. According to the inventor, A. A. Ostrander, a designer of fashion sets, there is no noticeable loss of color and clarity despite the enormous enlargement. Four blowers, mounted below the two lenses, force continuous streams of air through flexible tubing and against both sides of the slides to prevent their deterioration under the terrific heat of the lamps. Each lamp uses 5000 watts and is the same as those that illuminate airport runways for night operation. The projector was designed and built by Ostrander for use in fashion shows and exhibitions

KINDLING HOUSE is the proper name for this three-room bungalow because it is made of pine blocks sold as firewood. Glued together, the blocks form the frame. The house, located in Iowa, has a concrete roof

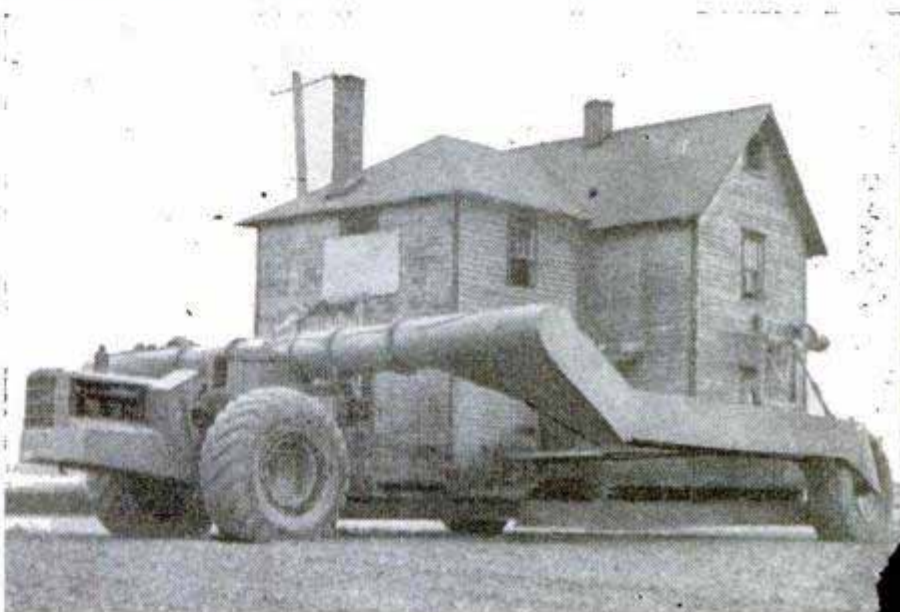


OCEAN-GOING CANOE is taking Mr. and Mrs. Ray Sullivan from Chicago to West Indies via the Mississippi. With both motor and sails to call on, they won't paddle the complete trip



Moving? Your House Can Go With You

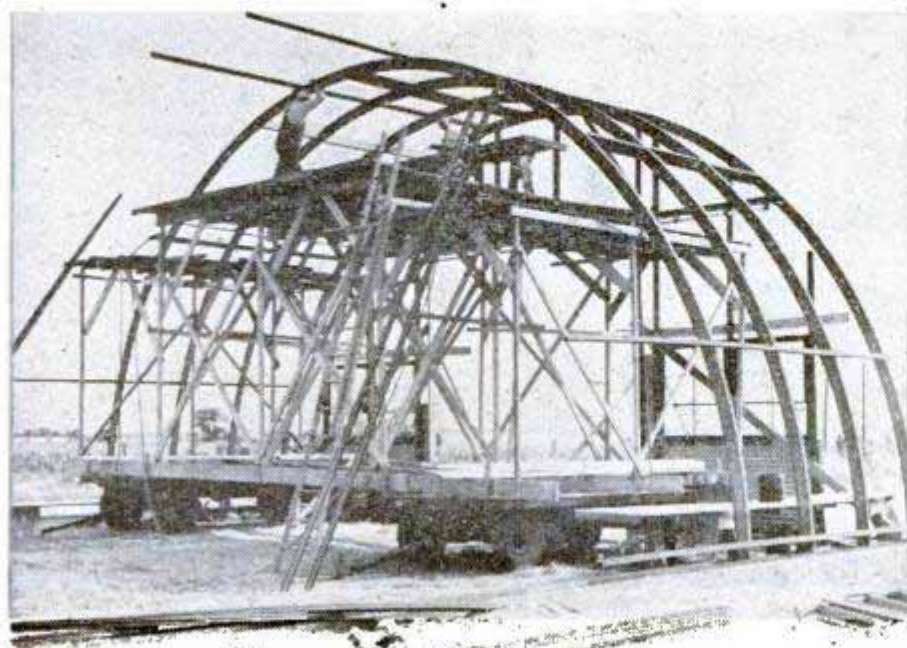
Army barracks from Tinker Field are turning civilian to house married ex-GIs at Oklahoma City University. The barracks are raised by jacks and blocks, lowered onto a trailer, and towed to the campus (upper right). That's one way to move a building, but a new power mover (lower right) makes the jacks-and-blocks system as old-fashioned as a muzzle-loader. The U-shaped body of the rig is backed around the house and powerful electric hoists quickly raise it from the foundation. The power mover then rolls away, the house held securely at three points. At the new site, the building is eased down on the foundation, and the rig moves away, the job completed.



Onion "Mickey Finns" Potent Weed Killers

Mixing onion juice with 2,4-D makes the weed-killing chemical 20 times more effective. Experimenters at Michigan State College found the greatest effect came when one part onion juice and 20 to 30 parts of water were mixed with the chemical. Curiously, there was no increase

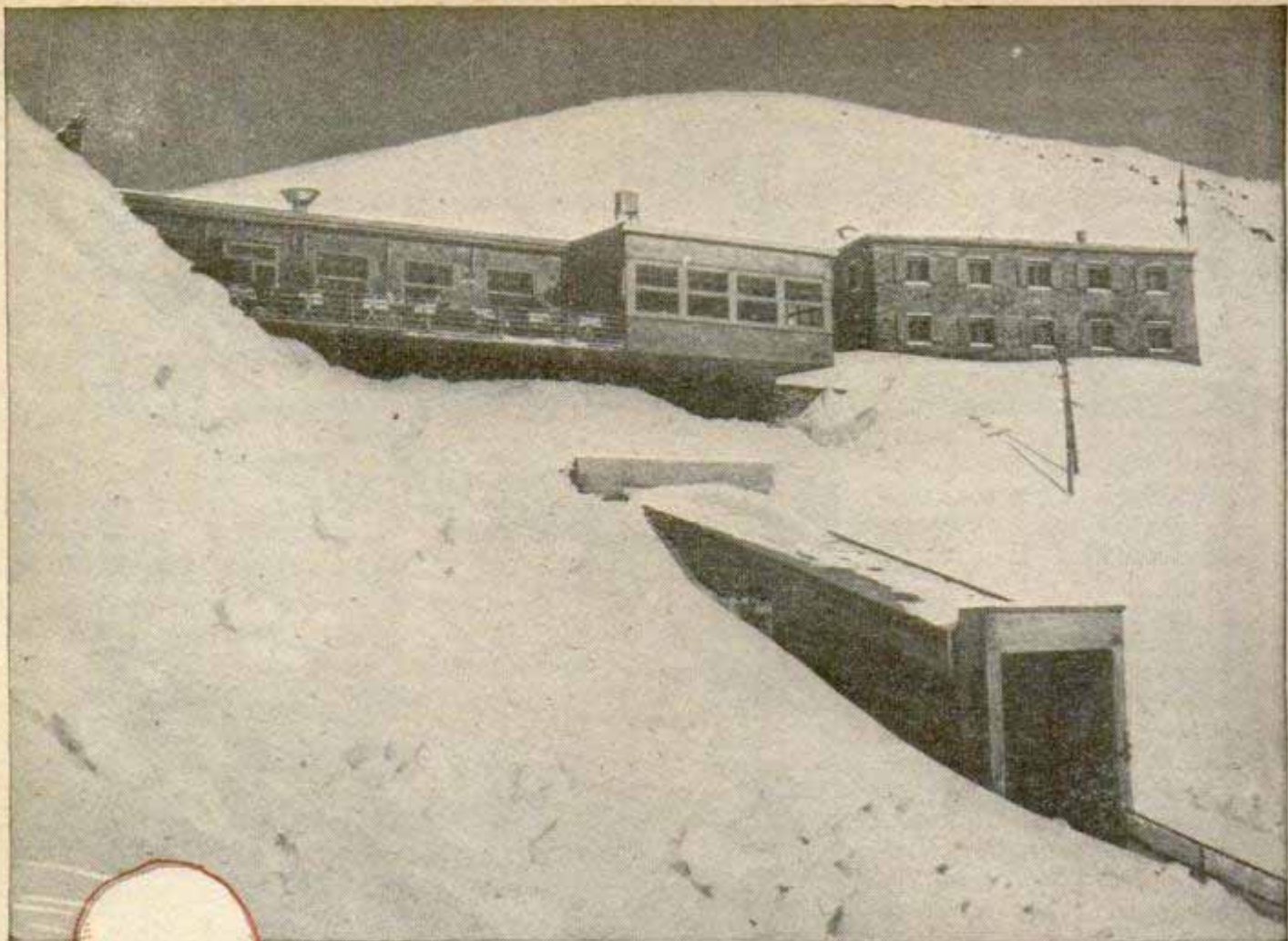
in killing power when garlic, a close botanical relative of the onion, was substituted, and tomato juice caused it to be even less effective.



Two Farm Wagons Carry Moving Stage

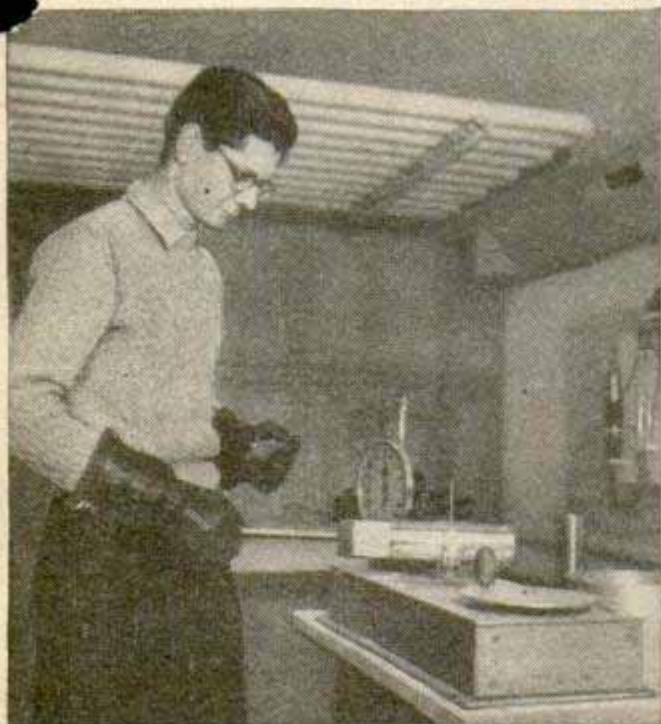
Two farm wagons supported a moving stage in the construction of a steel-arch building at Kouts, Ind. As work progressed the rubber-tired vehicles were pulled forward and their tongues staked down for safety.

☞ Sugar, pepper and sage do a better job of preserving frozen pork sausage than the same seasonings with salt added, according to recent tests conducted by the Army.



Avalanche "Lab"

"WHITE DEATH" is peaceful Switzerland's No. 1 enemy. On a single day in December, 1916, masses of snow and ice hurtling down the mountainsides killed 10,000. To study and "outguess" it, here are some techniques used at the Swiss Snow and Avalanche Research base in the Alps. Above, view of laboratories. Left below, device to measure force needed to cause a rupture in snow bed. Machine at right below gives data for setting up avalanche-proof construction





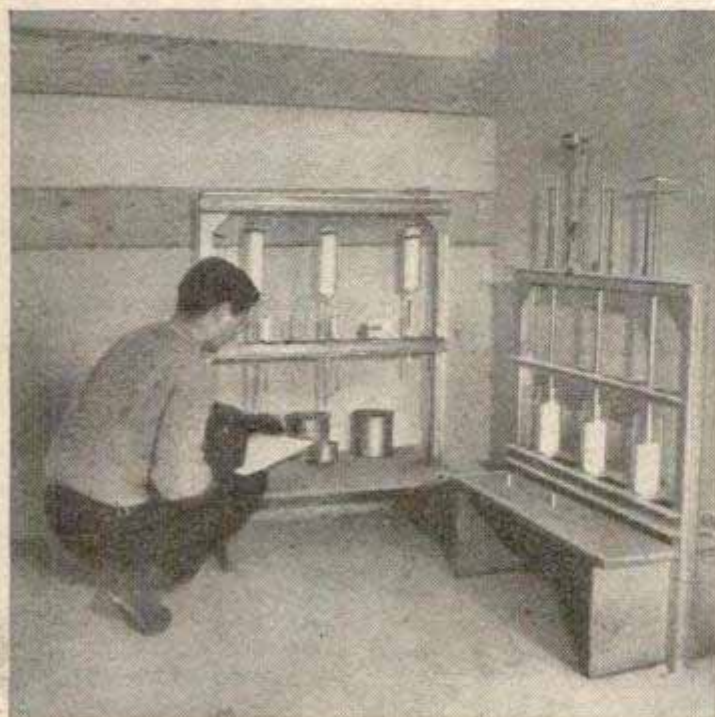
↑ Simple gauge to determine snow's water content. It helps foretell future behavior of big masses

•
Upper right, apparatus to measure pressure of snow falling from slope. Its force can uproot big trees

•
Right, method used by technicians to determine the resistance of snow. One of many field bases at rear

•
Below right, the characteristics of a snow-block's movement and speed are brought out by this device

•
↓ Worker at the avalanche laboratory subjects snow at left to traction, and at right to compression





"Paddlewheel" on Lightweight Tractor Churns Soil

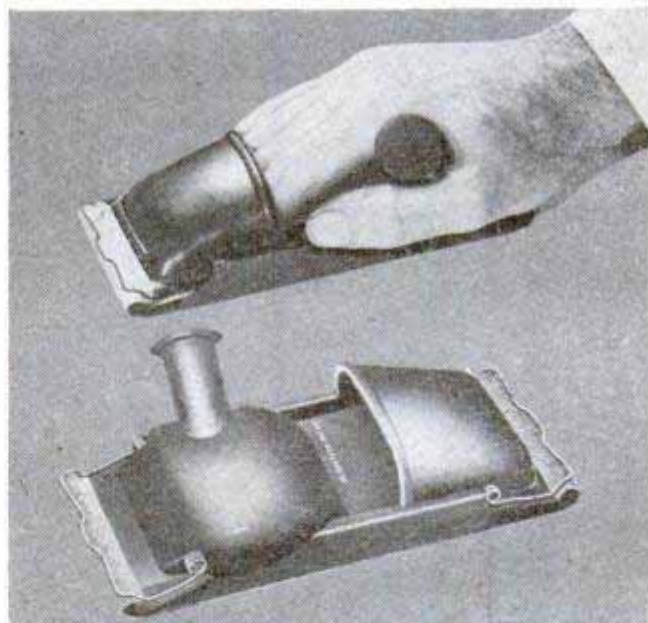
With its eight rotating tines mounted on rubber pads, a midget tractor chops and tills the soil smoothly even in hard ground. Weighing only 145 pounds, the tractor is chain-driven by a 1½-horsepower gasoline

engine. The complete frame, gear box and engine mount are cast in one piece of aluminum alloy treated to maximum toughness. A depth gauge is adjustable from one to five inches.



Trigger "Safe" Locks Out Accidents

Accidental firing of rifles and shotguns is prevented by a locking trigger "safe" that fits over the trigger assembly. Consisting of a felt-lined metal case, the guard has a brass-plated lock and key. On guns kept in the home, the device is locked to prevent tampering and dry-firing by children or curious adults. In the field, the safe can be used unlocked to prevent accidental firing while climbing over fences or through brush. A flick of the release button uncovers the trigger for quick firing. Lightweight, the guard comes in sizes that fit more than 150 models.

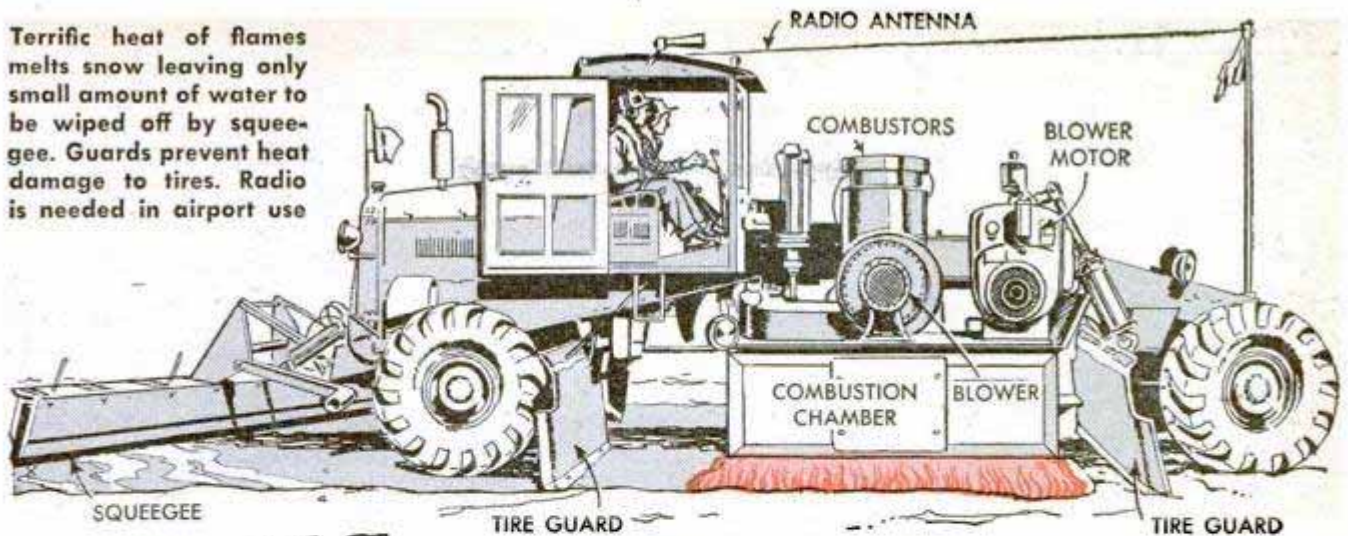


Rubber Block Speeds Sanding

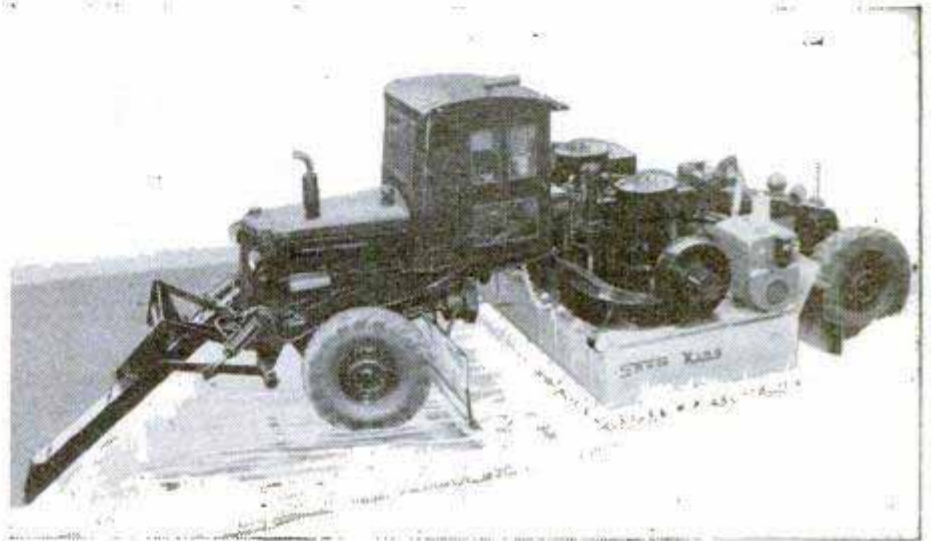
So flexible that it follows any surface contour, a hand sander block eliminates waste in abrasive materials and cuts sanding time. The block takes one third of a standard sheet of abrasive paper and two spring clips hold the paper securely. A soft rubber heel rest and handle at the rear of the sander and a finger pocket at the front minimize hand fatigue. The pocket also protects the fingers. A lamb's-wool bonnet can be used with the block for polishing.

FLAMES "BURN" SNOW LEAVING ROAD CLEAR AND DRY

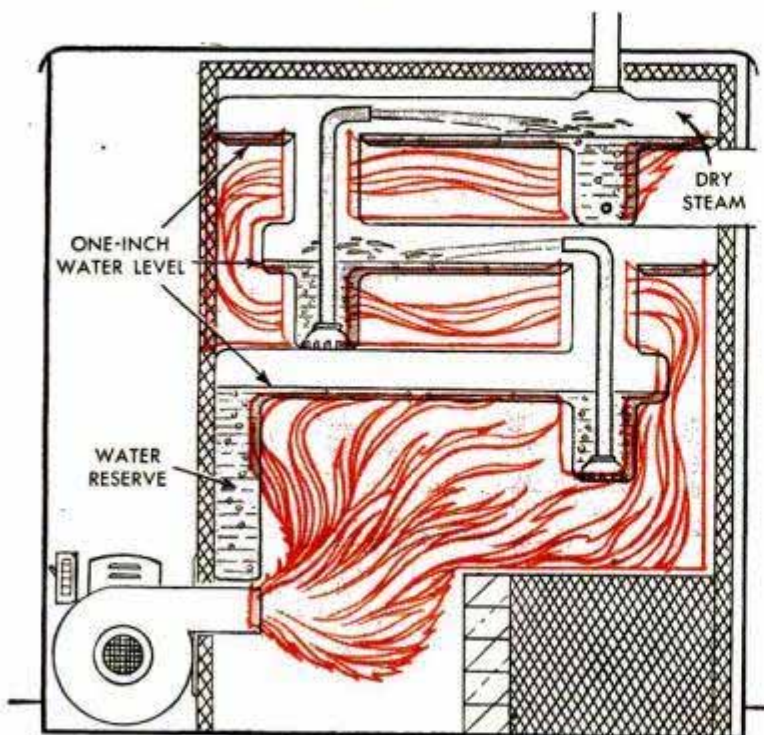
Terrific heat of flames melts snow leaving only small amount of water to be wiped off by squeegee. Guards prevent heat damage to tires. Radio is needed in airport use



Snow and ice vanish in the air when a snow-melting machine is used to keep roads and airport runways clear. Like a huge blowtorch, the machine, mounted on a road grader, blasts flames against the pavement, melting the snow on a 12-foot strip while moving up to 15 m.p.h. Used as soon as snowing begins, the machine leaves a completely dry pavement. When deeper snow is being removed, water residue is wiped off the pavement by a heavy rubber squeegee. Built by a Pittsburgh airport engineer, the snow re-



mover has two oil-burning combustors that "burn" snow for one cent a cubic yard, much cheaper than the old method.



Percolator-Style Boiler

Steam generates in four minutes from a cold start with a boiler that works like a coffee percolator. Water at the bottom, near the most intense heat, is moved up through the steam heads by "geyser" tubes. This eliminates the need for raising all water in the boiler to steaming temperature. The geysers also act as a check to keep an unvarying film of water in each head and to boost foreign matter to a flushing receiver at the top. Maintenance of a low water line prevents water being carried up into the mains.

☞ To create the extremely high vacuums needed in one phase of the atomic-bomb project, pumps were designed which would evacuate 999,999,999 air molecules of every billion present.

Hunting Big Fish

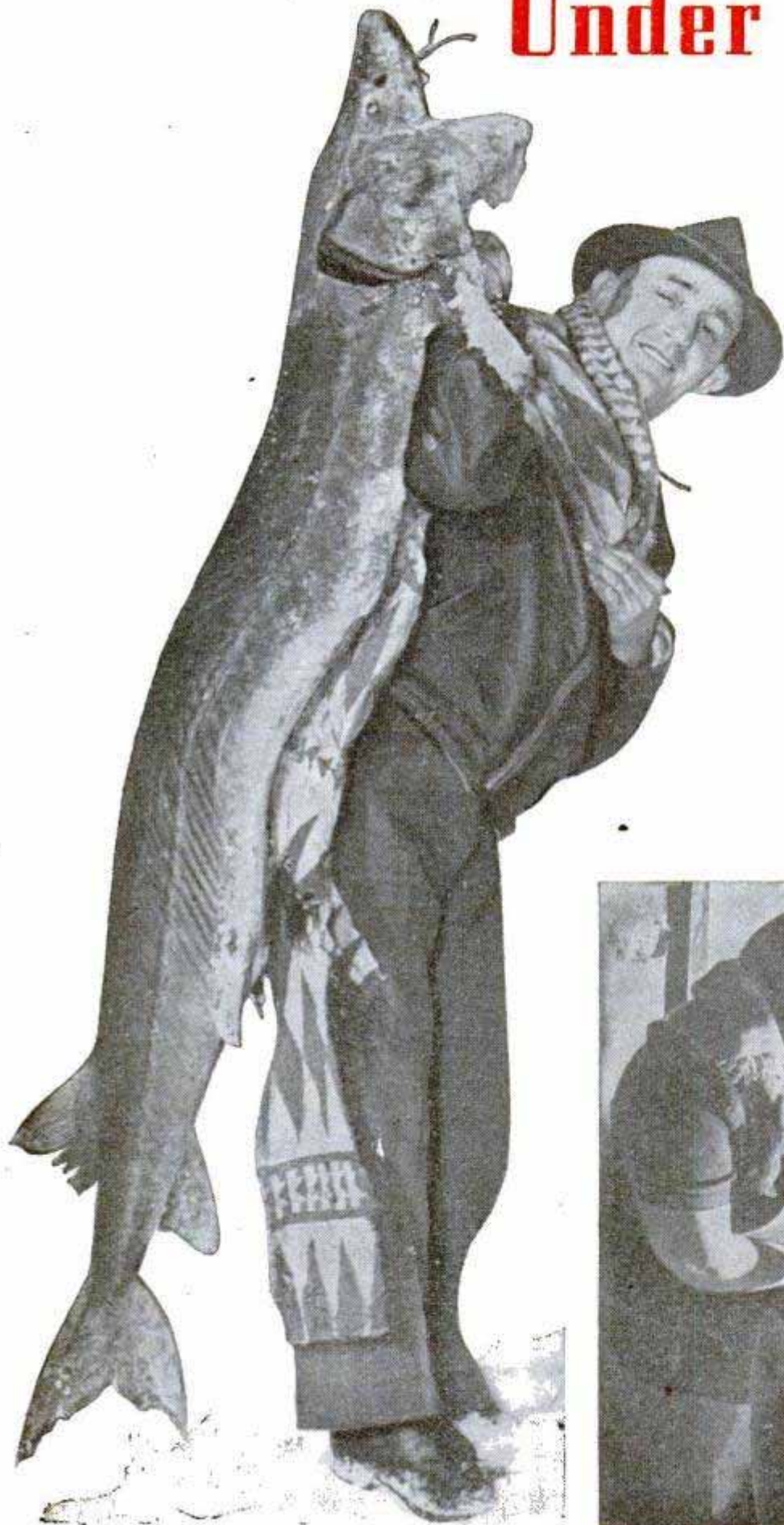
Under the Ice

By Don Dornbrook

STURGEON fishermen in Wisconsin like to tell the story about a man who once speared a 200-pound specimen as it shot through the sluice gates of a dam. This hardy fisherman hastily hefted his catch onto his back and was struggling across a nearby railroad bridge when the ugly giant gave one healthy kick which sent fish and fisherman flying off the trestle into the water. They fished out the fisherman a few minutes later — his prize catch, never!

Spearing sturgeon is akin to hunting big game under the ice. Dragged by main strength through

← Whopper! No trick photo, sturgeon measures six feet. Below, woman tries luck. Note gaff hook and decoy at knee

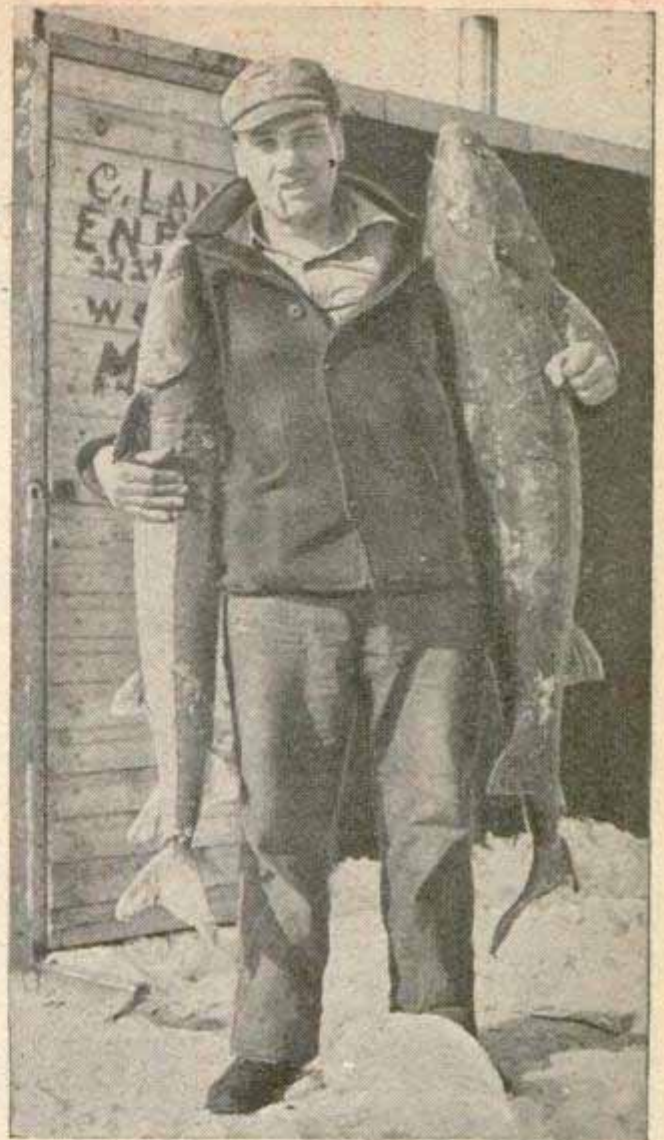


a 3 by 4-foot hole in the 22-inch-thick ice of Wisconsin's Lake Winnebago every February, many a sturgeon weighs more than the white tails brought home from the North during the deer-hunting season.

Nowhere else in the world is the sturgeon stalked with the spear as through the ice of Lake Winnebago. Three fourths of Wisconsin's lake sturgeon are found in Winnebago, the remainder in adjacent lakes—Winneconne, Butte des Morts, Poygan, Puckaway, Buffalo—and the Fox and Wolf Rivers. But it is out there on the bleak, icy reaches of the Badger state's largest inland lake—35 miles long, 10 miles wide—where a thousand or more fanatical fishermen peer into 10 or 15 feet of water, their devil-like, 8-foot-long spears poised for action. Men have been known to wait nine years for that thrilling moment. And when it finally arrived, some have been known to grow helpless—suddenly mesmerized by a sort of stage fright akin to "buck fever."

Winnebago—Indian for "dirty water"—is one of the nation's largest bodies of fresh water within the borders of one state, yet it is only 21 feet deep at most, averaging 18. It is in the east central part of the state, and its lake sturgeon—*Acipenser rubicundus*—is one of six types found in North America. Sturgeon six and eight feet long and weighing more than 200 pounds have been speared through holes in Winnebago's ice, although the average weight is between 40 and 50 pounds.

The Wisconsin Conservation Commission keeps a pretty accurate check on sturgeon spearing through the issuance of



↑ Milwaukee fisherman hugs 104 pounds of fish

↓ Lonely ice shack holds stove, chair and high hopes





Needle-sharp spears look like barbed pitchforks. This one has detachable head. Right, 6-foot 3-inch fish weighs 148 pounds—4 pounds more than the man

sturgeon tags—at five cents each. Every sturgeon speared must have a small metal tag affixed to the tail. Fishermen are limited by law to one fish a day, five a season. The minimum legal length is 30 inches. Commission records show that in 1945—a good season—920 sturgeon weighing a total of 35,290 pounds were taken from Lake Winnebago. In 1944 the “take” was 1000; in 1943, 238; in 1942, 467; in 1941, 788. Veteran fishermen estimate the 1946 catch at nearly 2000—including a 141 and 142-pounder. Last season the unsettled, muddy water made the fishing so bad—it was the worst in history—that fishermen vainly appealed for an extension of the February 1 to March 1 season.

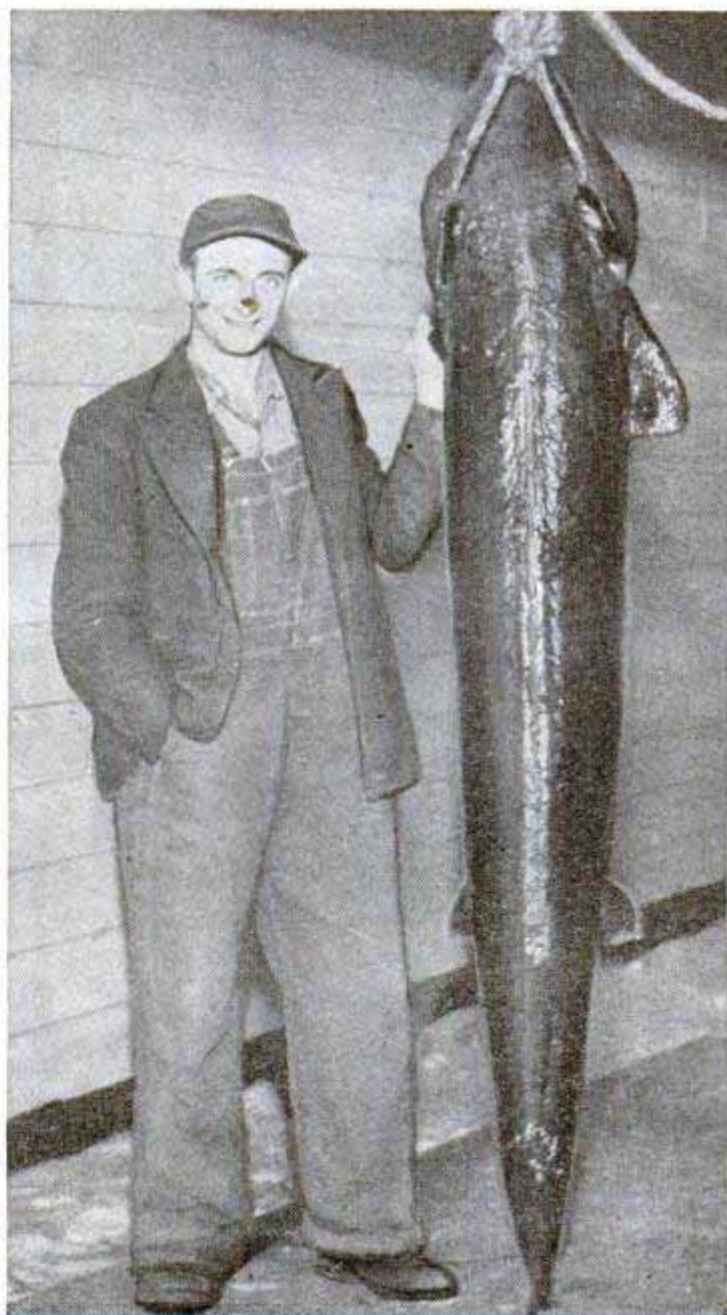
During the sturgeon season the vast whiteness of snow-covered, ice-locked Lake Winnebago is broken only by little villages of fish shanties. The biggest clusters of several hundred each are found on the eastern shore near Calumet Harbor and Stockbridge Harbor and on the western shore near the twin cities of Neenah and Menasha. In these tiny wooden shacks, the sturgeon spearer sits in silence and darkness. He is protected from storms on the lake which often reach blizzard proportions. More than one fisherman has become lost in one of these gales and occasionally some unlucky fellow drives an automobile through a crack in the ice.

A model shanty is about six feet square, with sidewalls about five feet high and a hip roof which comes to a point about three feet higher so that an eight-foot spear

can be set on the floor inside. About half of the shanty has a floor; the other half is open. This opening coincides with a hole chopped in the ice before the shanty is placed in position. There are no

windows, just one narrow door. The only light comes through the hole in the ice; it's surprising how much filters through even when the ice is covered with snow. Shanties are banked with snow to keep out the wind and heated by small, wood-burning stoves. It's a great sport.

Almost any easily moved shanty can be used. One fisherman made a shanty out of a sawdust hopper from an abandoned sawmill. Its conical top gave him plenty of room for his spear. Many a farmer in the area considers the sturgeon season his vacation. The best hours are from 10 a.m. to 2 p.m. The law says each fisherman must



remove his shanty from the ice as the season ends, but often a sudden thaw swallows up whole villages of fishing shanties.

The most important piece of sturgeon fishing equipment is the spear—which looks a lot like the one pictured with Satan. Every hole watcher has his own notion of the ideal spear, but all are pronged, filed needle-sharp to pierce the tough, rough hide of the sturgeon, and mounted on an eight-foot wooden pole or one-inch pipe handle.

Some fishermen prefer detachable spears, in which the spear itself comes loose from the handle when the fish is struck. Both spear and handle are tied to a 30 to 50-foot length of rope. The purpose of the detachable handle is to allow the fish to fight and roll and spend himself without having a handle to snap off or to use as a lever to tear the spear out of his body. A simple model is made from an old Ford auto axle, drilled out on each end. The pole fits in one end, the five-tined spear in the other. The spear is held in place by a small metal pin so that when the fish is hit the fisherman can pull back on his rope and disconnect the handle from the spear.

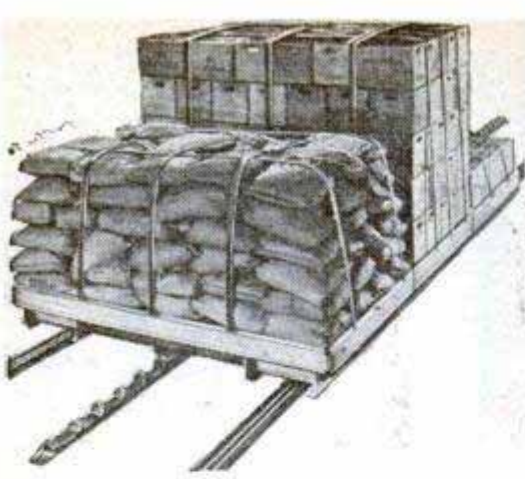
Eastern-shore fishermen say that Edward Thuerwachter,
(Continued to page 236)



Old-timer inspects a spear-head he has just finished. He tailor-makes the spears with his own forge, anvil

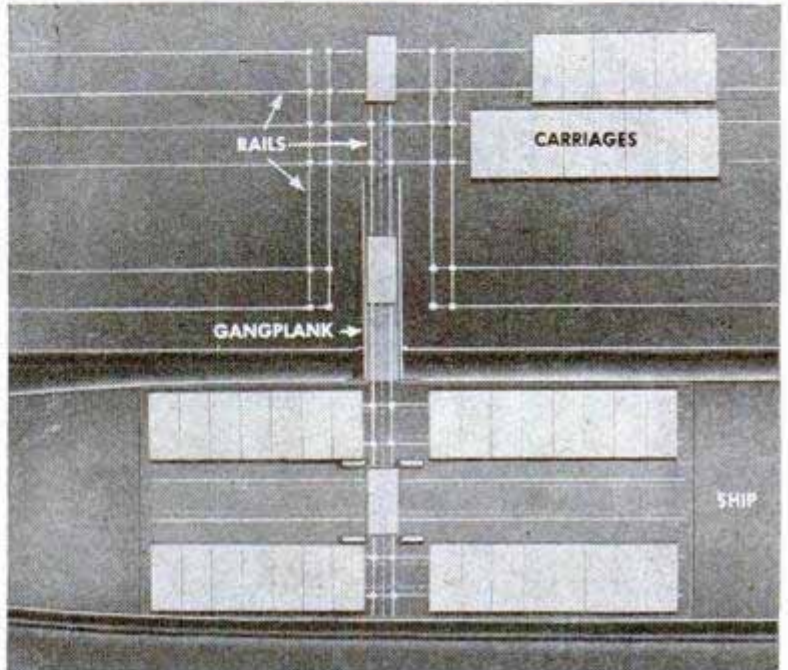
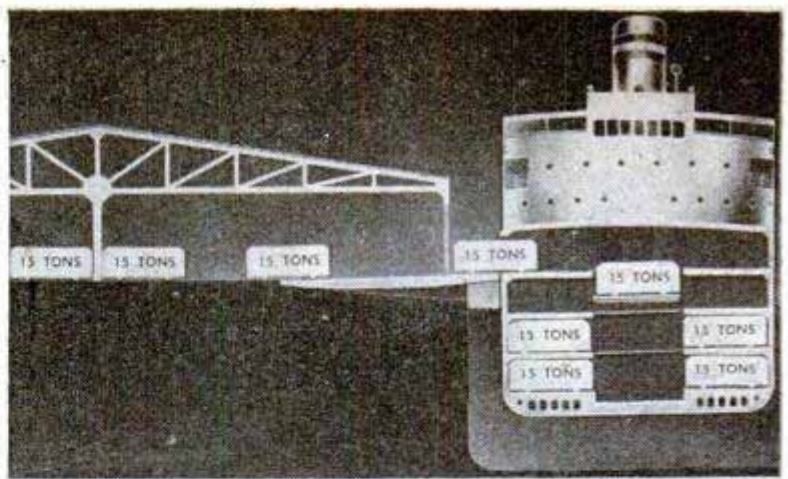
Sturgeon master sorts out decoys. They are made of wood. Weighted with lead, they serve as good lures





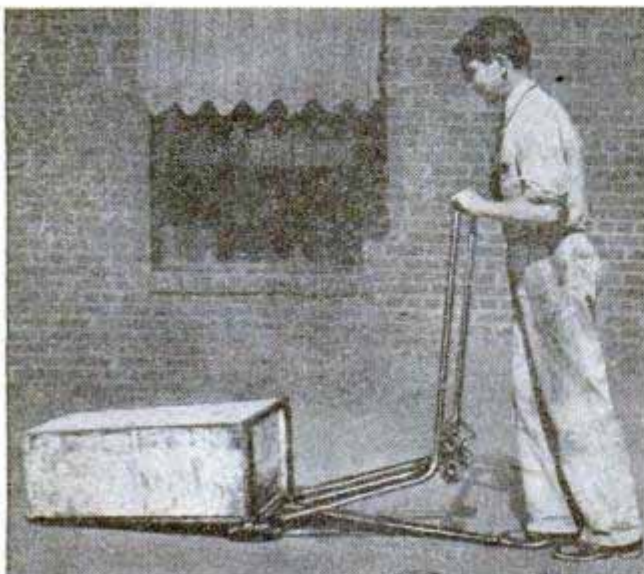
Rail-To-Ship Cargo System Cuts Loading Time

Cargo ships are loaded by rail with a new loading system that is expected to cut freight costs and speed the handling of cargo. Permanent rails are installed in rows on the pier, leading up to two gangplanks that connect the dock and the ship. Carriages more than 16 feet long and seven feet wide roll along the rails. Each carriage accommodates three aluminum pallets which are loaded with cargo. When the ship ties up at the dock, the gangplanks are installed and conveyor chains or pusher trucks move the carriages along the rails and up the gangplanks. Aboard ship, the carriages are distributed by elevators to the proper deck levels, and the carriages remain aboard when the ship puts out to sea. The ship is unloaded in the same manner. Under cargo-handling methods now in use, loading or unloading costs are estimated at four dollars a ton. With the new system the cost is expected to be less than 50 cents a



Top left, carts on rails carry loaded pallets up gangplank and aboard ship. Top, easily handled loads are stacked by elevator. Above, diagram shows how several side rails cross for loading

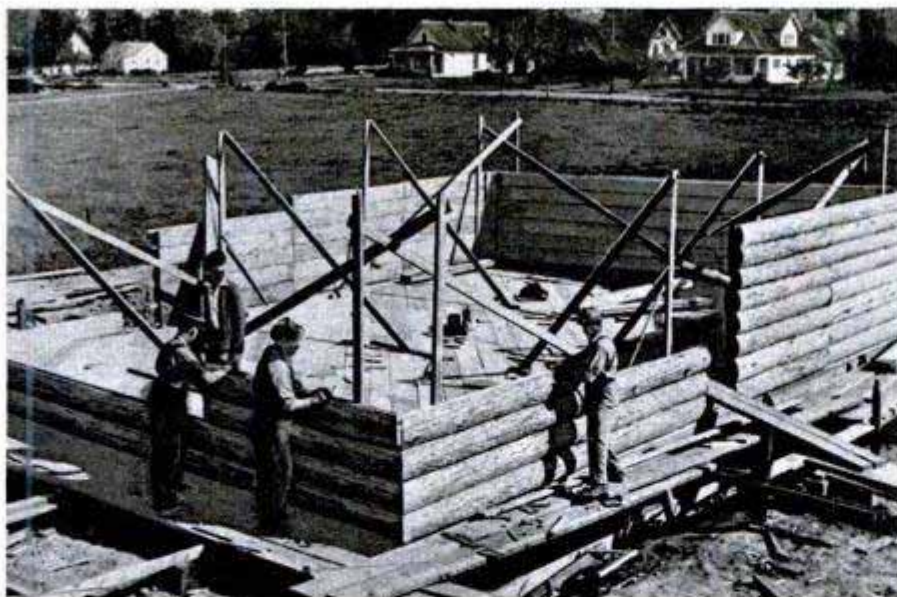
ton. Other advantages cited for the system are much faster loading and unloading, less breakage and the elimination of steel booms from the ship's deck, clearing the area for crew and passenger recreation.



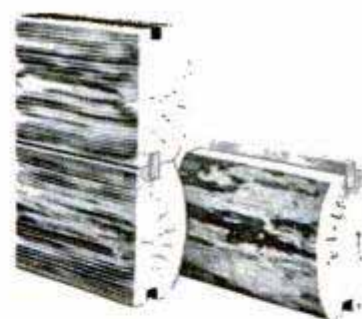
Hand Truck Eases Lifting

Weighing only 60 pounds, an all-welded hand truck is equipped with a patented lift to simplify the lifting and moving of crates weighing much more than the truck. It is constructed of steel tubing, formed into shape and then welded. Roller-bearing wheels are used at the front, and casters for the rear wheels.

You may wish to obtain additional information about the new products described each month in *Popular Mechanics*. If you want to know the name and address of the manufacturer or distributor, just write to Bureau of Information, *Popular Mechanics*, 200 East Ontario Street, Chicago 11, Ill.



Top right, logs, squared on three sides, are held together by narrow wooden keys. Above, walls are erected quickly. Below, completed cabin



Precut Cabin Logs Held by Wood Key

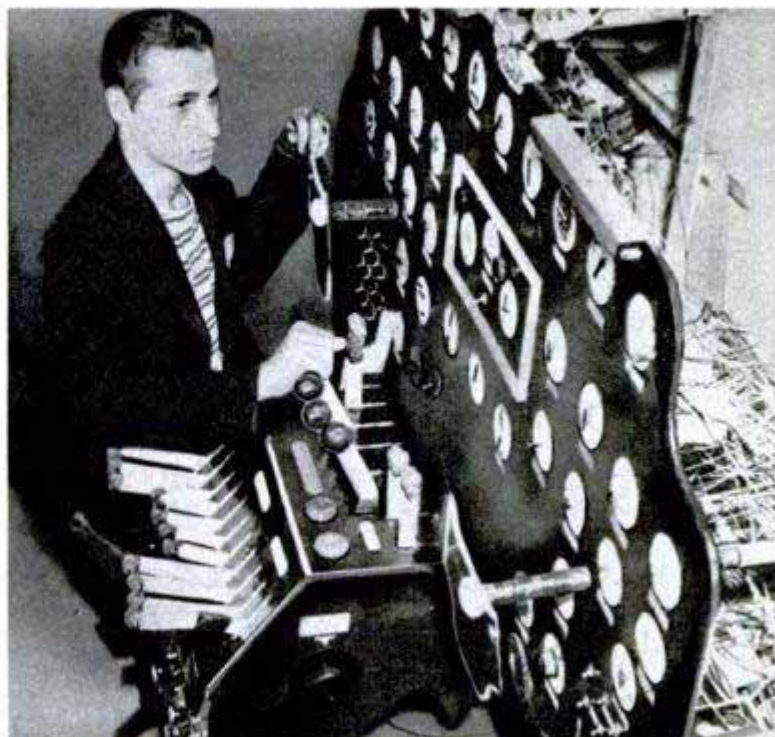
Patented logs are used in constructing a log cabin that can be erected in 32 hours. The logs are squared on three sides and grooved for a wooden key that holds them together rigidly. The logs are about 5½ inches thick, 8 feet 6 inches long and from 6 to 12 inches wide. The outside bark is peeled and the logs are treated to prevent discoloration and resist weathering and dry rot.

Ⓞ Soap so mild that it can be used as a shampoo or in hospitals or kitchens has been made by the U. S. Army Chemical Corps from the incendiary fuel used in flame throwers and bombs.



Youth "Flies" Giant Plane With Homemade Controls

All the controls and dials of a four-engine plane are included in an instrument panel built by 18-year-old Harold Secrist, Jr., of Niagara Falls. Each of the controls works—lights flick on and off, a landing gear retracts, de-icers work on model wings, and flaps and ailerons respond. The panel was built from old alarm clocks, parts from pinball machines, springs, transformers and motors. From the rear it is a maze of 250 feet of string and 400 feet of wire. There are 160 controls on the panel. Secrist has demonstrated his panel before clubs, schools and fairs, and Generals Spaatz and Doolittle have seen and admired his handiwork.





Consolidated Vultee Aircraft photos

Huge Bomber Gets Eight "Legs" To Distribute Weight Better

To make landings possible at a greater number of fields, the giant B-36's two 110-inch wheels have been replaced by eight 56-inch wheels. They are arranged in sets

of four to distribute the bomber's 278,000 pounds better. The new gears are also lighter, safer in the event of a blowout and have easier-to-service tires.

Fox photo



Geography Made Easy

British children can combine geography lessons with recreation at a beach resort on the Isle of Wight. A relief model of the island, built to scale, is included in a wading pool. The youngsters sail their model boats from one harbor to another and become familiar with the island's topography.

Industrial Uses for Bark

Bark of Douglas fir trees is converted into raw material for plastics, plywood glue, insecticides and soil conditioners by a process used in a western plant. Formerly, bark was considered almost worthless although it represents about 12 percent of a saw log. Approximately three quarters of the plant's output of an estimated 75,000 pounds daily is being used by plastics manufacturers. A series of grinding and screening operations prepares the bark for industrial use.

Movies Use Canoes As Aquatic Tripod

To film close-ups of actors rowing a boat on a Mexican river, movie technicians attached the rowboat to the bow of a raft made of native dug-out canoes. The men in the rowboat will appear to be all alone when the movie is shown. Actually, a full camera crew was behind them on the raft. The camera was shifted to one canoe for close-up shots.

Extra Wiper Arm Clears Windshield

Attached to any windshield wiper, an extension arm clears a large portion of an auto windshield covered with rain or snow. The extension consists of two plastic pieces, the longer one clamped to the regular wiper and the shorter one holding the extra blade. In motion, the spring action at the pivot joint and the dragging action of the small blade gives the wiper clearance to clean a large area.

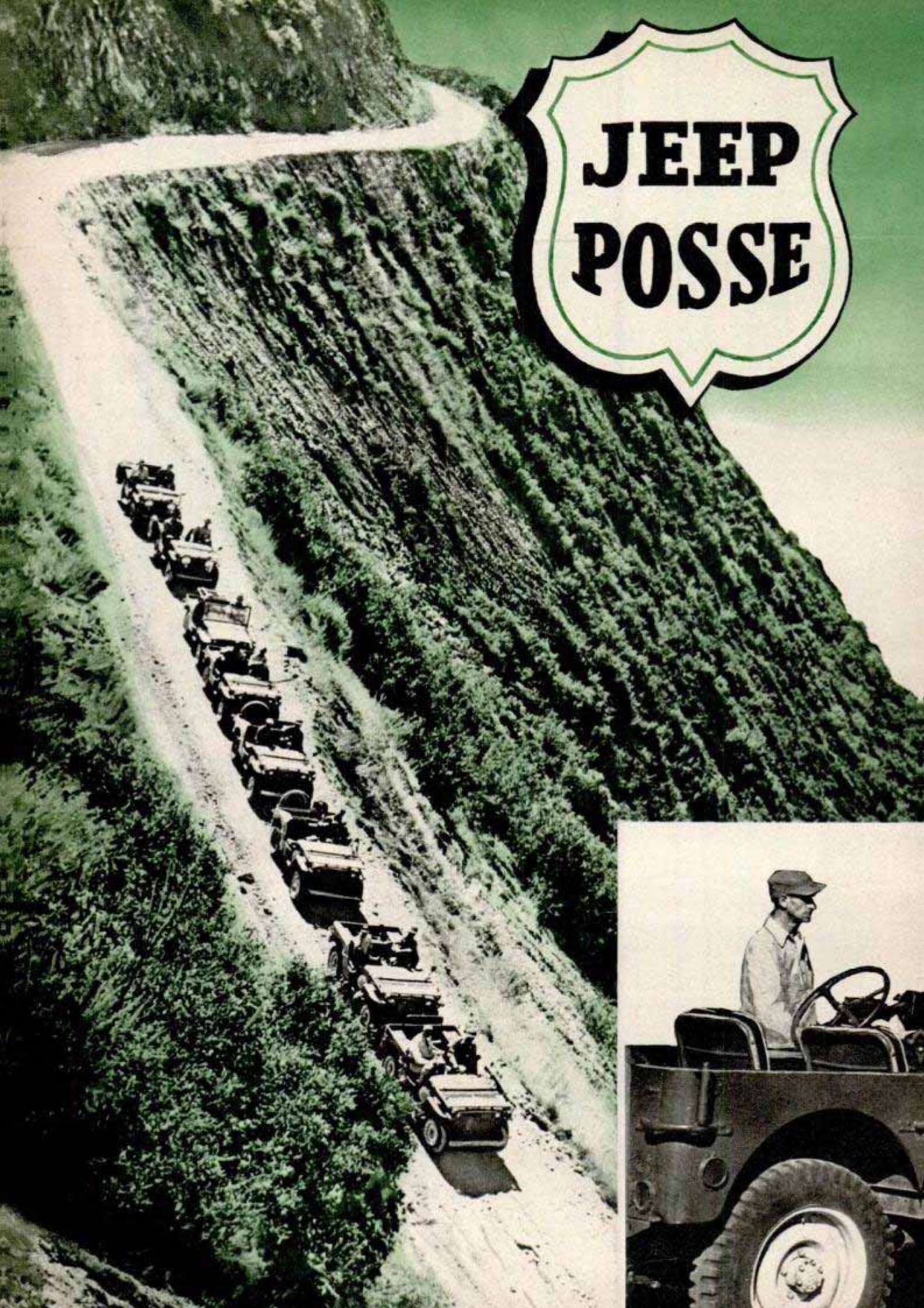


Electric Roaster for Wieners Cooks Six in 90 Seconds

Hot dogs "electrocute" themselves in a table-type electric cooker to become thoroughly heated in 90 seconds. There is no heating element, as the wieners themselves act as conductors for the electric current. Their resistance causes the heat which cooks them. To start the action, water and salt are added to the cooker which holds six wieners.



JEEP POSSE



THE JEEP is telling the saddle horse in western stables to move over. Men who once tossed a saddle over their favorite horse, now jump into the seat of the versatile jeep and take off through the fields.

Out in Bountiful, Utah, these "jeepers" have discovered that the chubby cars will take them just about any place they want to go—and in a hurry.

One Sunday afternoon a group of jeep enthusiasts was talking about their mechanized horses at a local service station and before the afternoon was over they had formed a club. At first it was an informal organization of about 15 jeep owners. They met every Sunday just for the fun of it. Like motorcyclists, they rode up and down the winding mountain roads of the Wasatch Range in formation.

But the group, led by Merk Christensen and Bill Bissell, soon discovered that it could help the community and still have lots of fun. The members talked to the city council about the group's possibilities. Given certain limited powers of policing, the group became known as "Official Bountiful City Jeep Posse." Since then, the posse has been serving the city as an extra law-enforcement and fire-fighting body. Today there are 27 jeeps and 54 men in the posse.

After a recent plane crash in the city, several posse members arrived at the scene in jeeps within minutes to help control the fire. As trained volunteer firemen, they pitch right in with the regulars and the jeeps serve as handy transportation.

Posse members organize search parties for missing persons in the foothills of the mountains and during deer-hunting season they serve as mounted game wardens pa-

trolling the wooded area around Bountiful.

But their most important function is fighting forest fires. The steep slopes of the Wasatch Range are covered with thick timber that holds back the water. The canyons are precipitous and thousands of square miles of timber grow on slopes exceeding 45 degrees. As long as the trees are there, the water from heavy rains and melting snows does no damage. But if the slopes were denuded by fire, the narrow canyons would be endangered by floods.

Working with the forest rangers, the posse members patrol the watershed daily during dangerous dry periods. When smoke is sighted, the jeep rider rushes to the telephone and notifies the forest service and posse headquarters. Equipped with shovels, axes and other fire-fighting equipment, the jeeps can pour out of town and arrive at the fire in a few minutes.

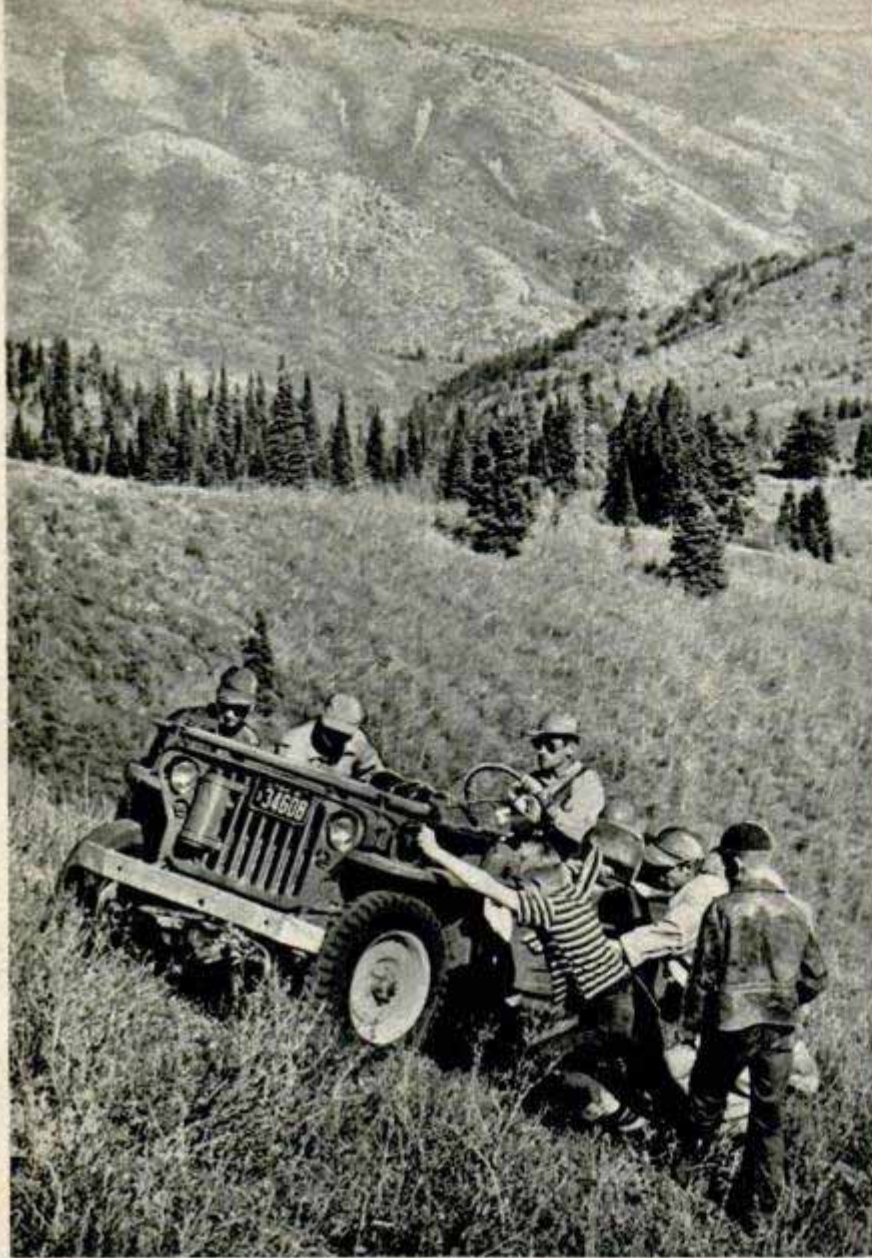
Forest fires are best controlled at the start. In the first few hours, the fire can be handled by 30 to 40 trained fire fighters. The posse can get that many men to any fire within a 100-mile radius in quick time.

However, all the posse's activities are not work. The group meets Sundays for a session of fun and competitive driving. The members vie with each other at negotiating tough terrain in an exciting game of follow-the-leader. There are times, of course, when even jeep-lovers have to admit that the little car is not all-powerful. When this happens they pitch in to help the jeeps over rugged terrain. With eight or ten strong men working together, the light vehicles can go anywhere.

At a recent meeting the posse decided to pioneer a road up a granite cliff. The

Sunday afternoon the Jeep Posse turns out for its regular meeting. After the business is over, some of the members take off on a follow-the-leader ride over steep mountain roads (opposite page) they know so well





Above, even the powerful jeep has to admit defeat sometimes. Members of the posse help the tiny car up the steep incline. Below, atop a high ridge, the men relax after the rough ride

only way they could reach the top without a new road was over a winding trail that took hours of riding. With a new road they could reach the area in about an hour. So off they went.

The lead jeep started up the steep incline and at one of the dangerous spots it got out of control. The driver leaped to safety, but the car rolled down the slope like an awkward snowball. It turned over 20 times by actual count before landing upside down, suspended in some trees. It took ten men to get it back up the cliff.

Once back on its four wheels the rugged jeep went back to town under its own power! To be sure, it needed a new windshield, some new headlights and a few dents had to be pounded out of the body, but it was ready for the next attempt the following Sunday. This second time the posse made it and now there is a road—not a super-highway, of course, just a bare trail—up the granite cliff.

The Jeep Posse is busy this winter studying first aid, new fire-fighting techniques and planning new roads in the mountains.

While overseas, thousands of GIs dreamed of the day when they would be turned loose in the wide open spaces with a jeep and a tankful of gasoline. Today that overseas dream has come true for members of the Official Bountiful City Jeep Posse.



Loading a Barge? Sink Her First

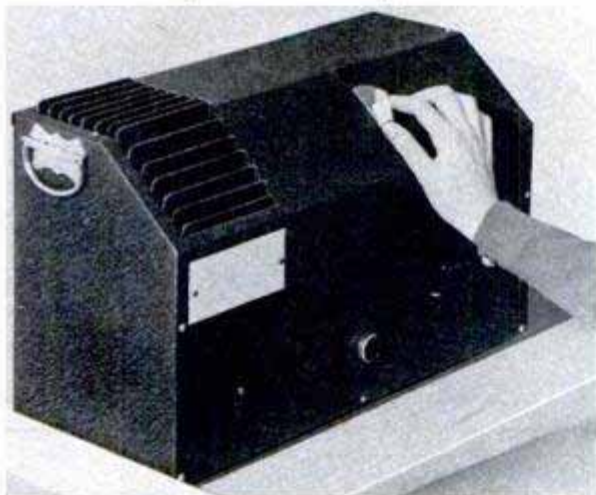
Sinking a barge was the only way to load her in a recent drydock operation at the Todd Shipyards in Seattle. To be loaded aboard the barge were six surplus Army tugs for shipment to Argentina. The 168-ton tugs could not be hoisted aboard so the barge was floated into the drydock and holes burned in her hull. When the drydock was lowered, water flowed into the barge and she sank. Then the tugs were floated into position, fastened to the deck of the barge and the drydock was raised. With the barge out of the water the holes were welded shut.



The tugs were not sent on the 10,000-mile voyage under their own power because it would have been costly and hazardous.

Enclosed Ultraviolet Germ Killer Protects Eyes From Harmful Rays

By reducing airborne bacteria and other micro-organisms in the air, a small germicidal unit cuts down the spread of disease in schools, waiting rooms and business offices. The air is drawn over an ultraviolet lamp that is completely enclosed to prevent its rays from injuring the eyes. In addition to its germicidal function, the unit also filters the air to remove pollen and dust, keeps the air circulating to make the room more comfortable in summer, and has a heating element for warming the air in winter. It plugs into any 110-volt circuit.

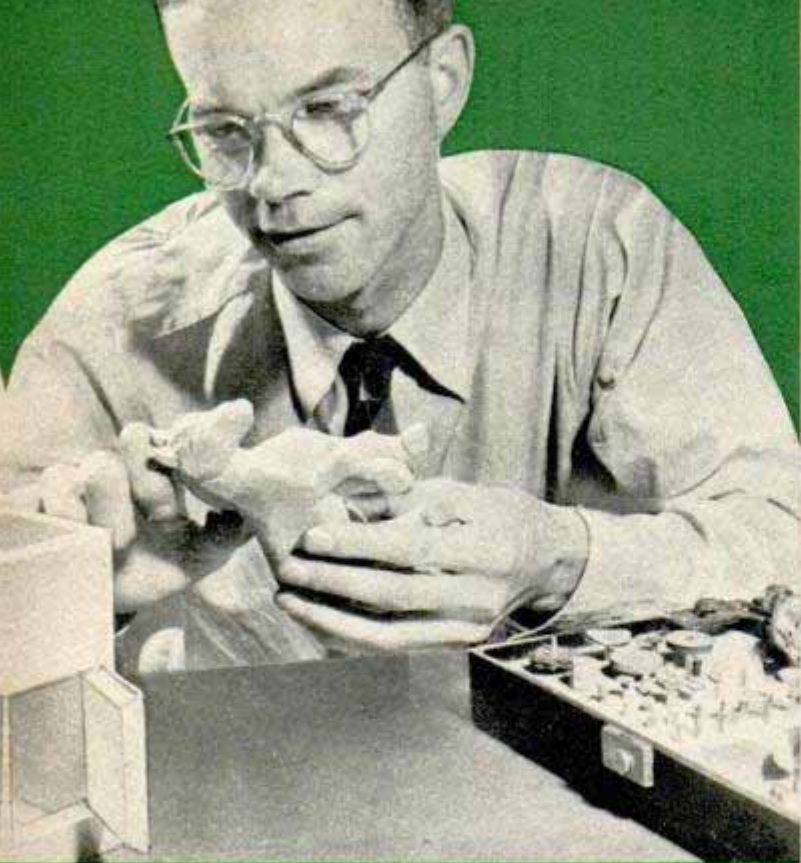


Flying Automobile Uses Two Engines

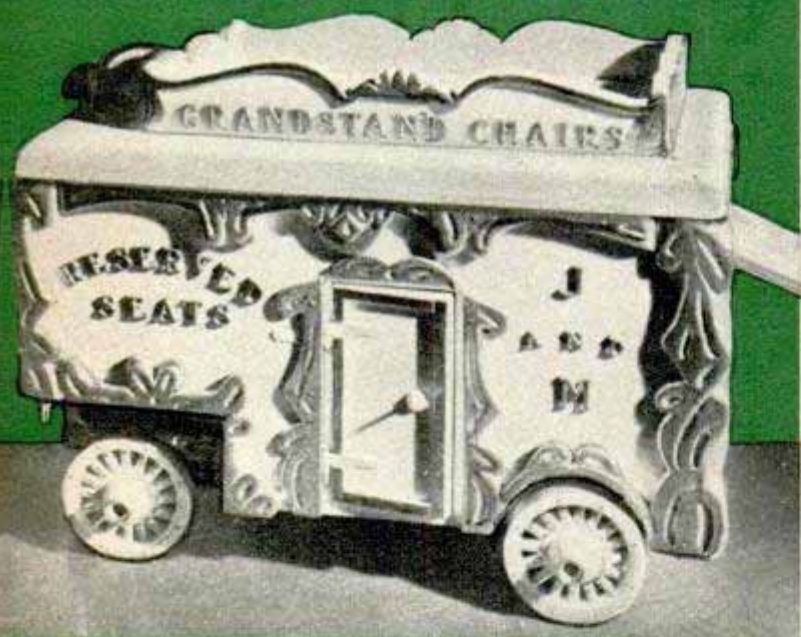
In contrast to previous designs, Consolidated-Vultee's experimental flying automobile keeps the main features of both kinds of transport. The 34½-foot wing, nacelle and 190-horsepower engine are a permanent unit. A separate Crosley engine powers the automobile. At the airport it is attached in a few minutes to a conventionally designed small automobile by bolts through the latter's roof. In flight it resembles a plane that has scooped up an automobile, bird-of-prey fashion. The craft is operated both in the air and on the



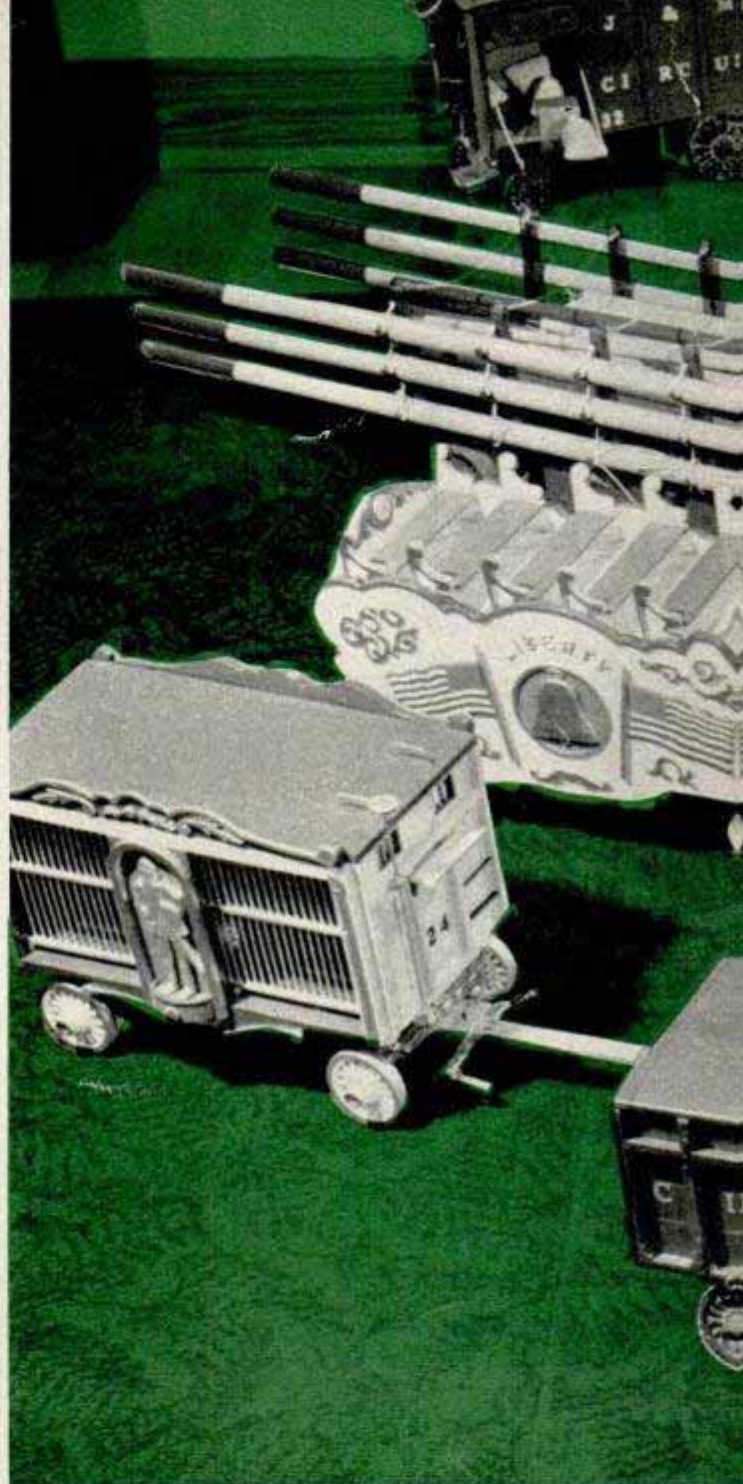
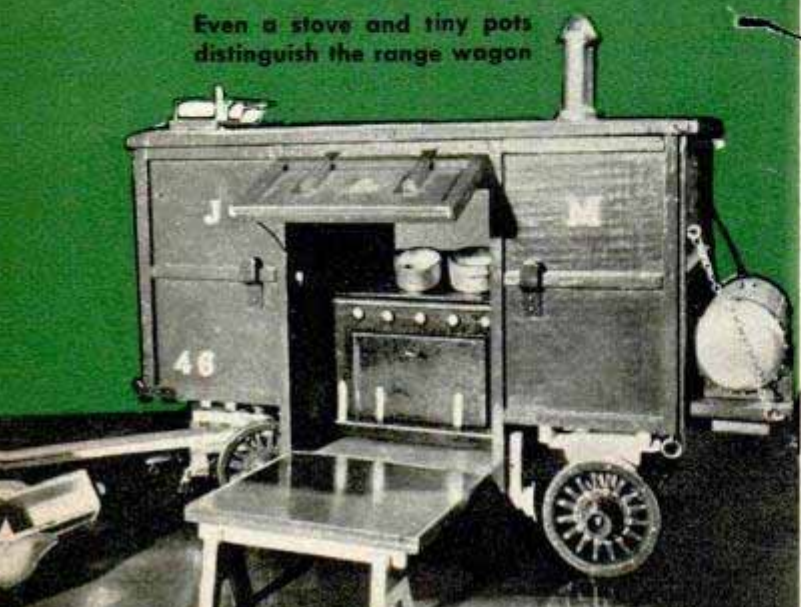
ground from the usual driver's location. The test model ran out of gas and crashed, but experiments will continue.



Perfectionist Ted Neumann carves Belgian wagon horse. Below, ticket wagons require intricate work



Even a stove and tiny pots distinguish the range wagon



By Rod Van Every

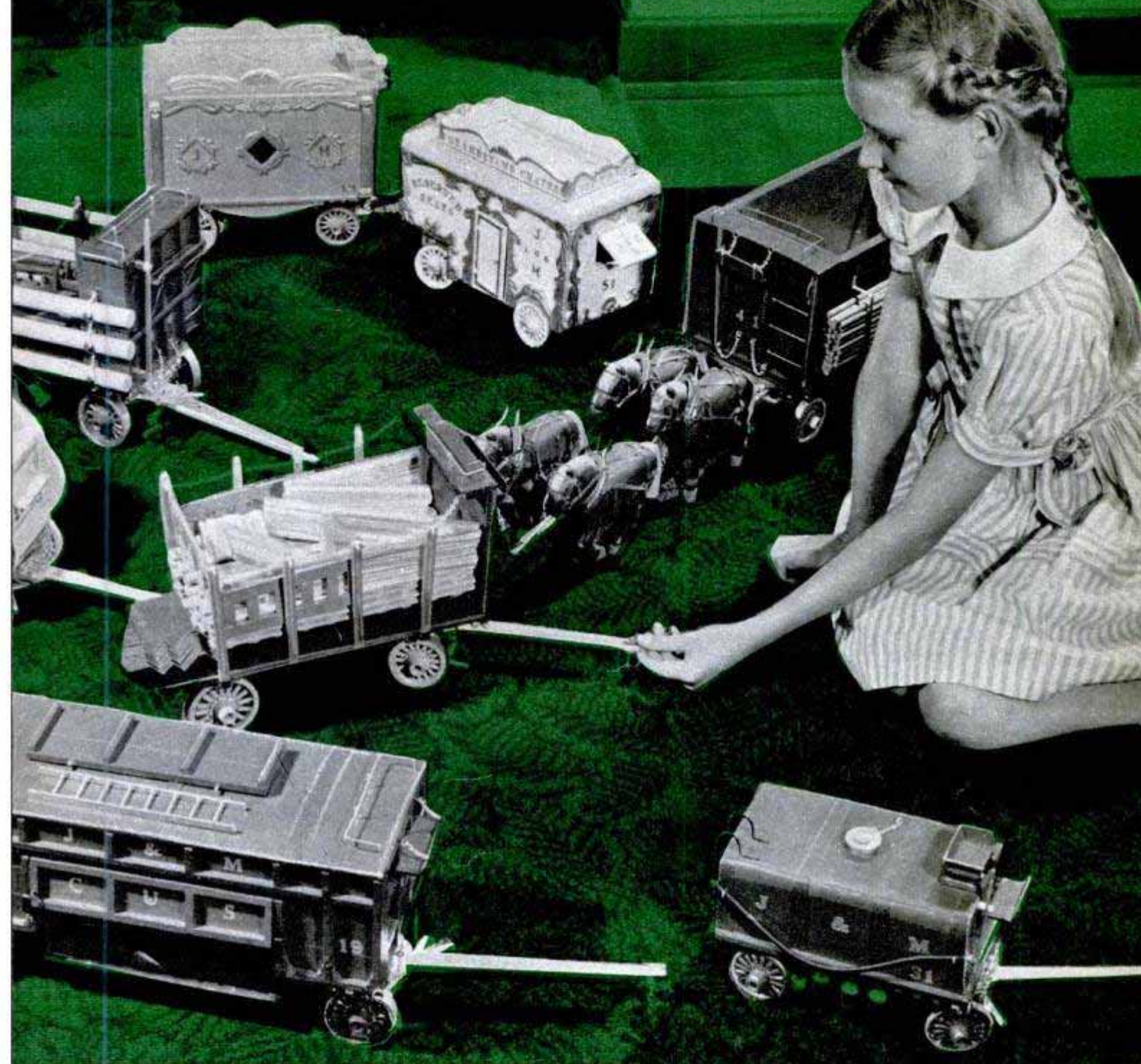
Photos by John Sigrist



IF YOU are looking for a hobby that will be good for a lifetime, you can't do better than to choose the circus—a model circus, that is.

Most hobbyists would rather not be commercial about their hobbies, but the model circus can be job insurance and a swell moneymaker in a pinch. It can be taken "on the road" like a real one, or it can be leased to large city department stores, especially at Christmas time or circus time.

Circus time, too, is the time to gather your data, the minute detail which brings whoops of delight from the children.



HAND-CARVED CIRCUS

Armed with a camera and a little nerve, you will find the circus itself is your best blueprint. Observe it and photograph it.

Don't expect, though, to finish your circus in one lifetime if it is to be a spare-time hobby. There is almost no end to it. The more detail you put into it—the more of a realist and perfectionist you are—the more lifelike it will be and the longer it will take you. That's part of the charm.

Most fans start with the wagons, one of the most colorful aspects of the circus. By the time you've built and carved 70 of them, you will be a few years older. Then

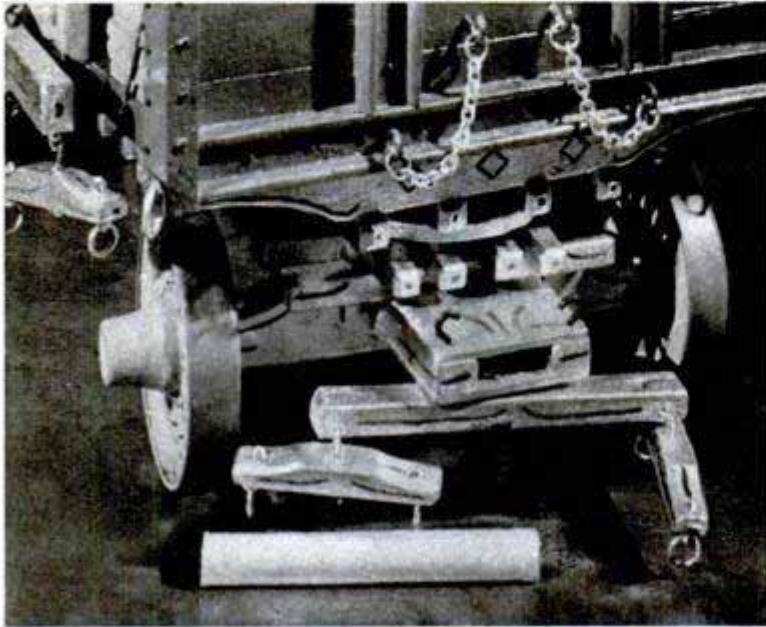
there are the teams on teams of heavy dray horses, the wild animals, the show horses (ring stock and "rosin backs"), the big top itself, the side shows and the circus train. If you still have a few years left in you, there are hundreds of human figures—workers, performers and audience.

All of this can be accomplished with a minimum of expense for materials and tools. And in the end—if you ever reach the end—you may have a hobby worth \$15,000, perhaps more.

The experience of one model-circus maker will serve as an example.



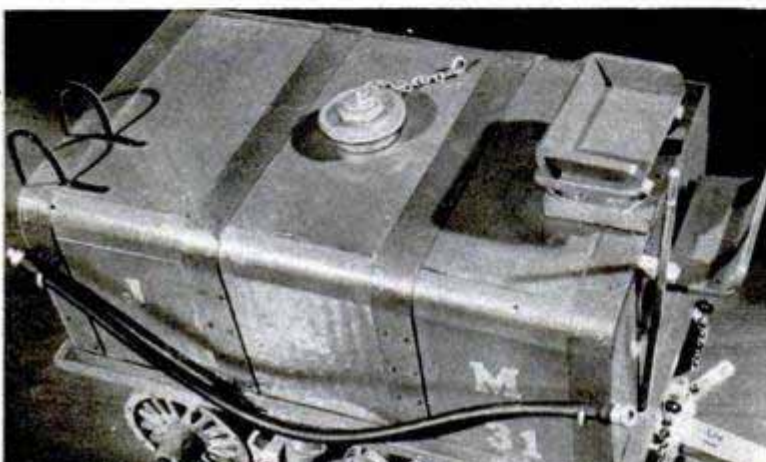
Plenty of room for spectators! All seats fit perfectly into wagon at left. Note tiny sleds in the foreground



Close-up of wagon's front assembly, showing lead-tired wheels. Cigarette gives you some idea of vehicle's size



Marion Neumann gazes into rear doors of cook's supply wagon. Below, hobbyists strive for perfect detail. Hose is piece of old tubing and tongue is numbered to wagon



The J & M circus of 39-year-old Ted Neumann is at the two-year stage. He has built 24 wagons and carved four dray horses and assorted circus paraphernalia. All in wonderful detail, and that takes time.

Neuman lives in Manitowoc, Wis., where he works for a Great Lakes shipyard. There he finds, free, most of the materials for his circus. The well-seasoned, easy-to-carve pine and basswood come from discarded ship molds and patterns. Most metal parts are reworked scrap and wire. The bars on the animal cages are cotton-applicator sticks.

He has to buy paint, nails, glue, sheet lead for wagon tires, and gilded letters. Many times the difference between a professional-looking job and a strictly amateurish one is the lettering. Better buy them at a novelty or stationery store. The right paint is more difficult to mix than you might think. Circus colors are distinctive and not just any red, yellow or blue. All of Neumann's paints are from the ten-cent store.

His favorite and most-used tools are an old jackknife and an inexpensive set of carving knives. He also has a power-driven jigsaw and hand-size drill-grinder, but they can't do much that the old jackknife can't do, although they are great timesavers.

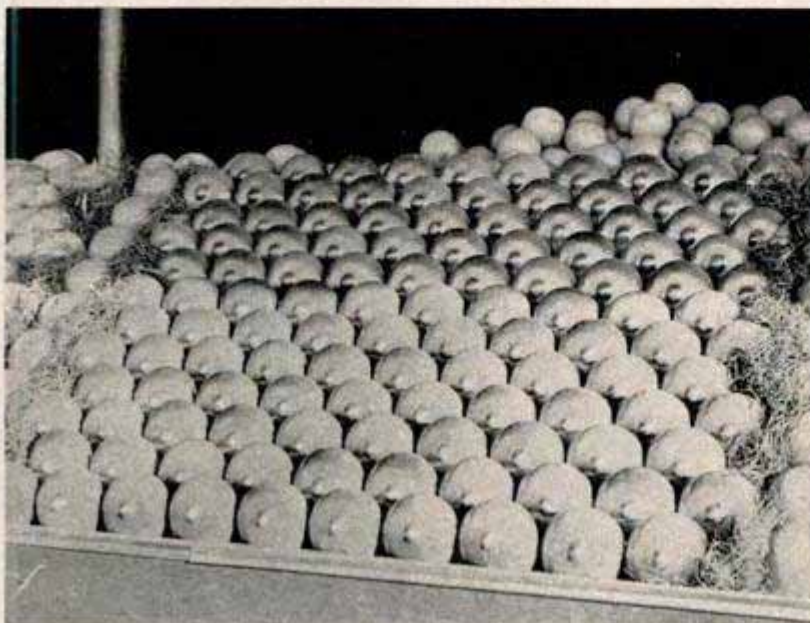
Neumann chose a scale of three quarters of an inch to one foot and selected the Ringling Bros. and Barnum & Bailey Combined Shows of 1936 as his model. Why 1936? Well, it was about then that the heavy circus horses began to give way to the tractors, trucks and "cats." A lot of romance was lost, and Neumann wanted that.

He named his circus the J & M for his son, Jack, and his daughter, Marion, but don't depend upon your son or daughter for more than a lively interest in playing with the models.

To obtain the detail for his work, Neumann spends several days a year with whatever circus is close to his home. He also joined the Circus Model and Owners Association, from which he obtained plans and specifications.

The circus never had a set plan for its wagons. It built a wagon to do a specific job, and that's why there is so much marvelous variety in them. There are animal cages, each different to fit the needs of the beast it houses; the blacksmith wagon with its forge, extra wheels, anvil and sledge hammers; the range (cook's) wagon, cook's supply, commissary (the only green wagon in the Ringling circus), canvas carriers,

(Continued to page 256)

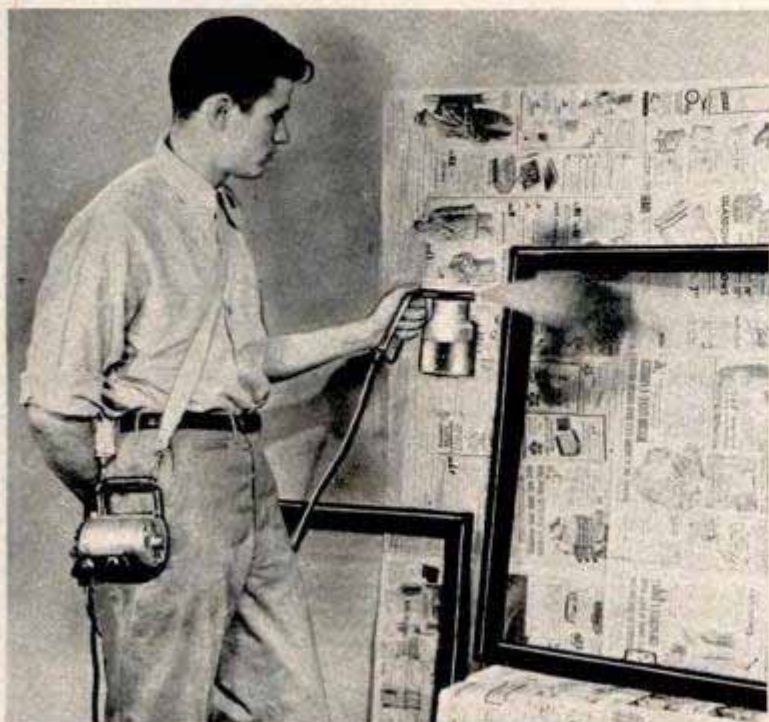


Above, strings of grapefruit permit faster arrangement of displays. Top left, which are real? The flat bases give only clue. Left, plaster onions

Dummy Foods Make Displays Attractive and Long-Lasting

Shoppers don't worry about how many customers have handled the food before them in some stores in California because the counter displays are artificial copies of the fruit and vegetables on sale. Several companies are making the displays. Some are made of plastic and others of plaster

reinforced with fiber. Usually, the dummies are made in rows to facilitate arranging. After painting, they look like the real thing, but they eliminate worry over rough handling by customers, dehydration by the sun and petty thievery. In addition, clerks do not have to change displays daily.

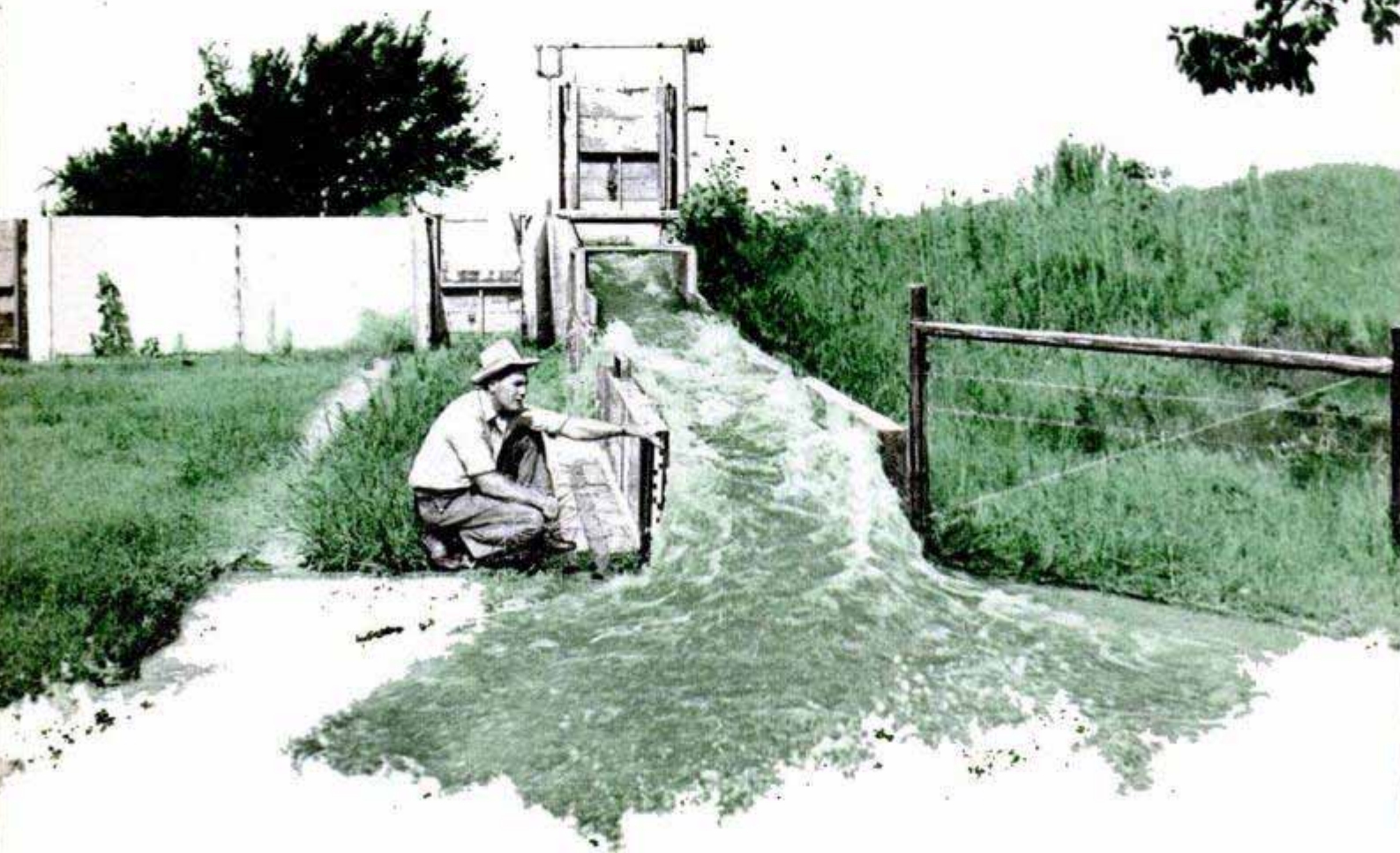


Over-The-Shoulder Sprayer Lightens Painter's Load

Less weight is carried in the hand with an electric paint sprayer that has a shoulder strap for supporting the motor. The sprayer consists of an a.c.-d.c. motor that develops 22 pounds of air pressure, the carrying strap, a four-foot air hose and the spray head with tank and nozzle. The nozzle can be adjusted to spray straight ahead or vertically. The electric cord is 10 feet long.

Information, including manufacturers' names, concerning products described in this issue may be obtained by writing Bureau of Information, Popular Mechanics, 200 E. Ontario St., Chicago 11

Engineer checks the depth of water gushing at 80 feet per second from one of the concrete flumes to sweep across the grass-lined test channel



Testing ground for grass . . .

DOWN IN OKLAHOMA the state has gone into a partnership with the Federal Government to grow grass. Not a penny has been made from this enterprise—yet if the results are applied, the nation stands to save millions of dollars a year.

The testing ground is the Outdoor Hydraulic Laboratory at Stillwater, Okla., run cooperatively by the Soil Conservation Service and the Oklahoma Agricultural Experiment Station. Lab workers are growing many types of grasses to find out how firmly each one anchors the soil in place. If the nation applies the results it can save a good share of the 4,500,000,000 tons of topsoil that are washed down the drain each year as a result of erosion.

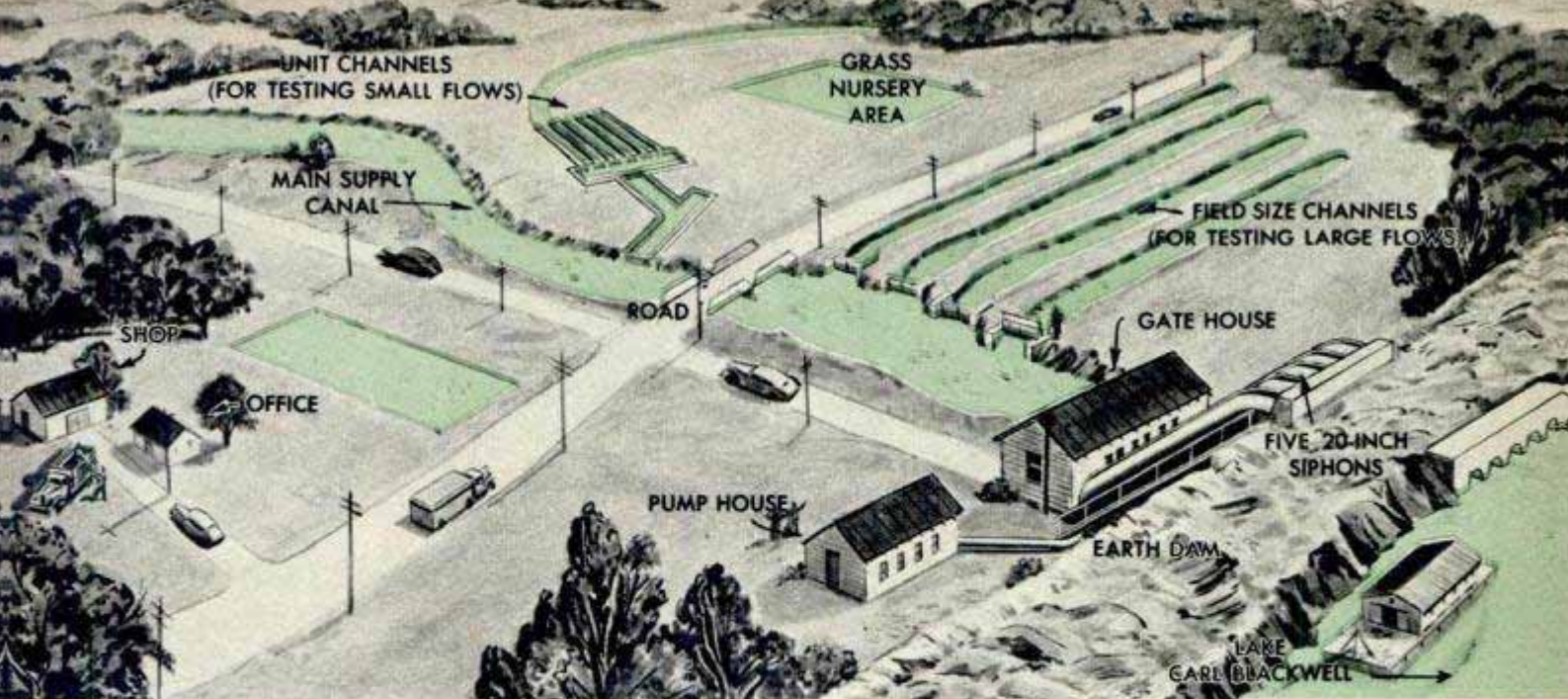
At Stillwater, under the direction of Bill Ree, a husky civil engineer, many experi-

ments have been conducted on the design of runoff channels and kinds of vegetation with the greatest holding ability.

The mechanics of controlling runoff water after a rain can be demonstrated very easily. Take a garden hose and turn it full blast against the bare soil of a flower bed. A hole will appear in the bed. Now turn this stream against your lawn at close range. Little or no soil will be removed. The grass deflects the water, and roots hold the soil in place. That in simple form is the problem that United States Department of Agriculture scientists are working on.

Study of drainage canals and vegetal cover began in 1935 at Spartanburg, S. C. However, in 1941 the laboratory was moved to Stillwater, Okla., where better facilities could be built. Located just below

By Andrew Hamilton



Artist's drawing of the test lab shows lake and siphons at lower right and test channels at upper right

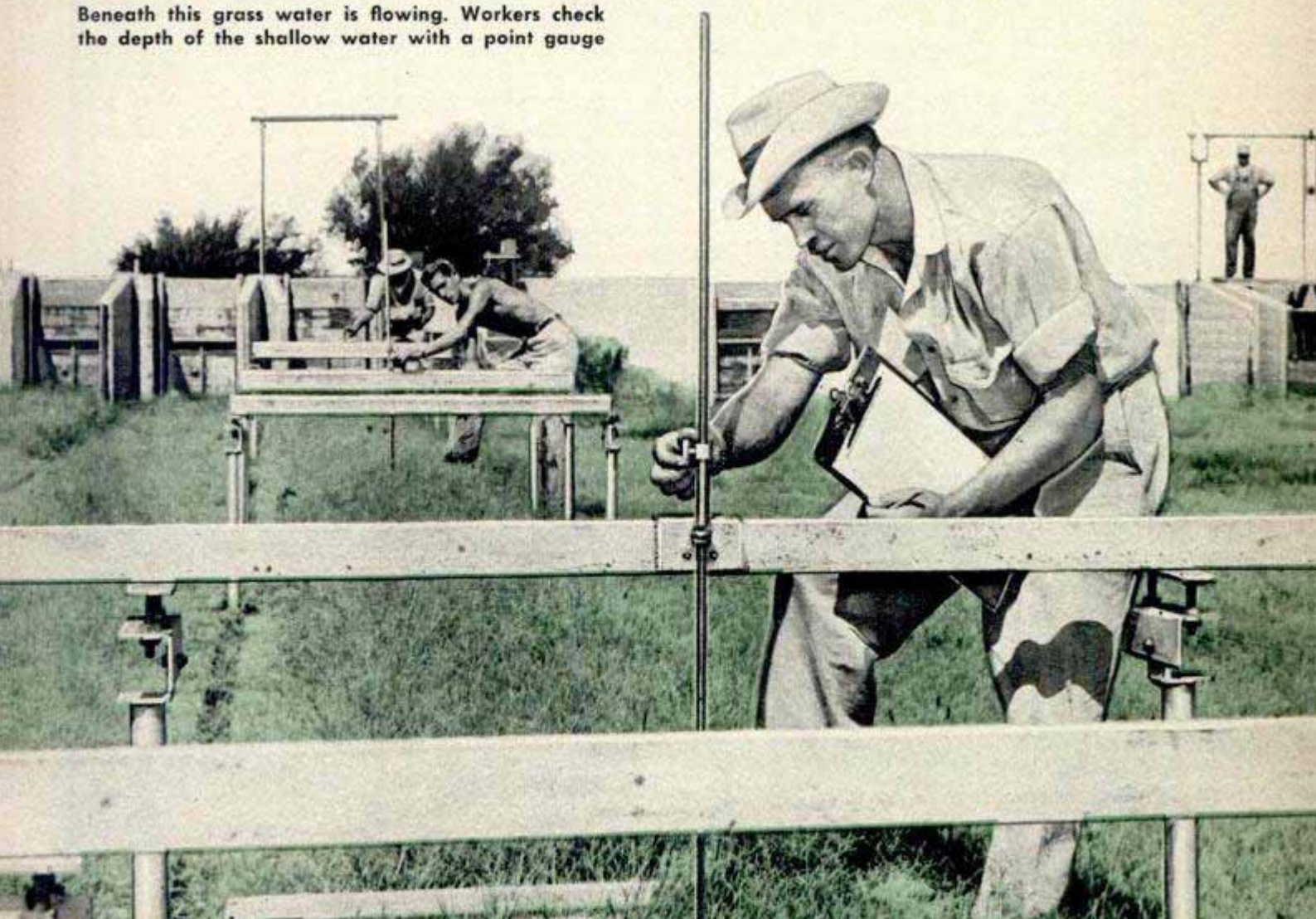
the lip of 3000-acre Lake Carl Blackwell, the laboratory today comprises a \$50,000, 75-acre testing ground. From the lake five giant 20-inch siphons draw water at a rate of 200 cubic feet per second and distribute it into channels of various sizes and shapes, planted with a wide variety of grasses.

The open-air laboratory and channels were built by engineer Ree and his assistants. In addition, they have devised and

built much of their testing equipment in a machine shop on the laboratory grounds.

The problems of hydraulics have been studied since the early days of the Babylonians and Egyptians. But vegetated drainage ways offered new and challenging problems. What about steep and abnormally rough channels that carried rainwater only for short periods? The heavy silt load? These were engineering problems

Beneath this grass water is flowing. Workers check the depth of the shallow water with a point gauge





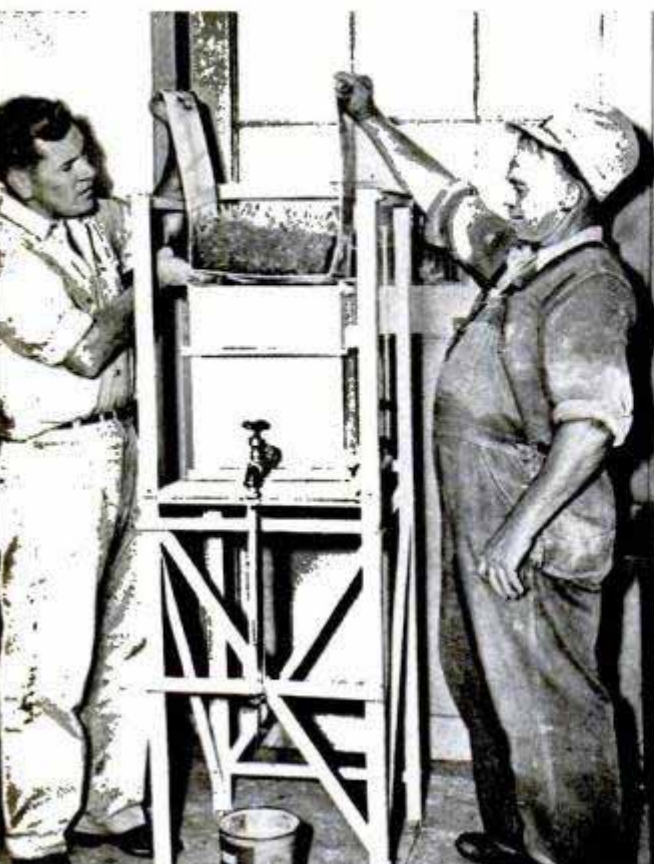
These two channels were exposed to the same flow of water, yet a gully a foot deep was scoured in the weeping lovegrass at the left, while the Bermuda grass at right shows no signs of damage from flowing water

that had not been worked out before. Would the drainage ways be cheap enough for the average farmer to build, yet structurally adequate for the purpose they were to serve?

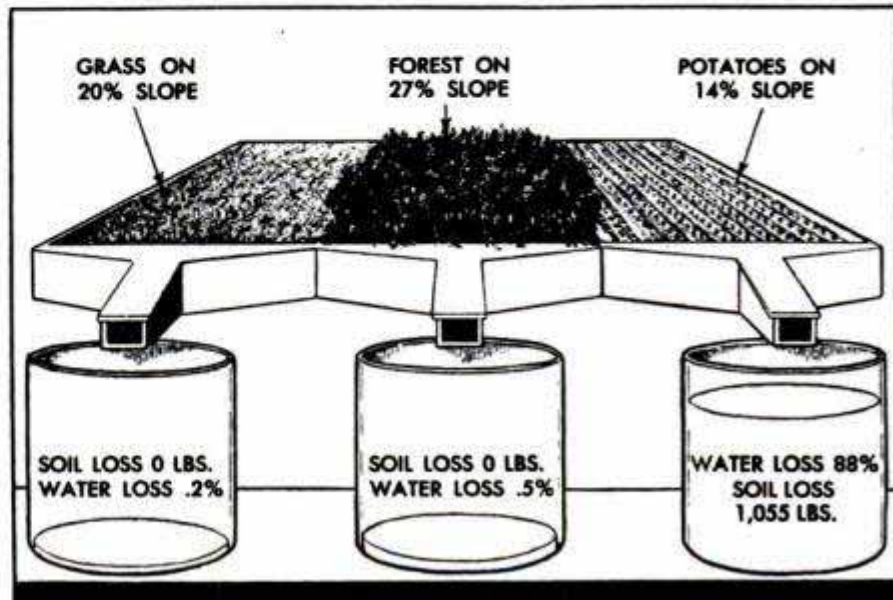
The hydraulic problems of erosion are tackled in the same scientific manner as a bridge is built or a skyscraper is erected. Information on two principal subjects is sought: just how much and how fast water can flow down drainage channels before erosion sets in; and how effective var-

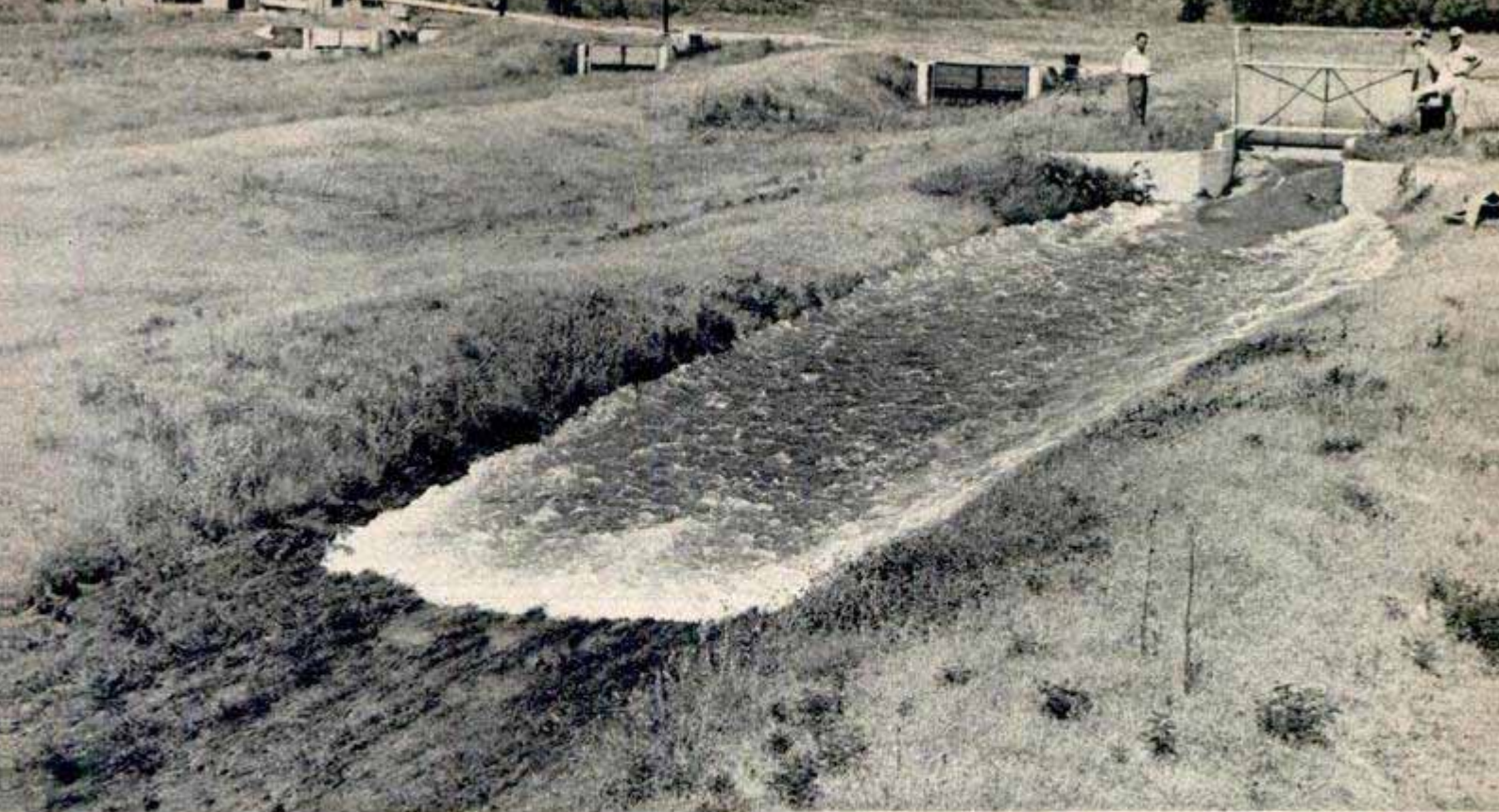
ious grasses are in slowing the speed of the flow of water.

Experiments involve the most exacting kind of hydraulic engineering. Ree and his co-workers measure the speed of water as it swirls down channels of various sizes; they calculate the amount of water passing a certain point; they note what happens to grass after water has raced across it for several hours; they compute results according to the slope of the channels; they record conditions under which erosion



← Into a volume-measuring instrument goes a sample of sod. The device measures the density of vegetation. Below, tests made at Cornell University show that the water runoff from a field of potatoes is much greater than that from grass or forest land





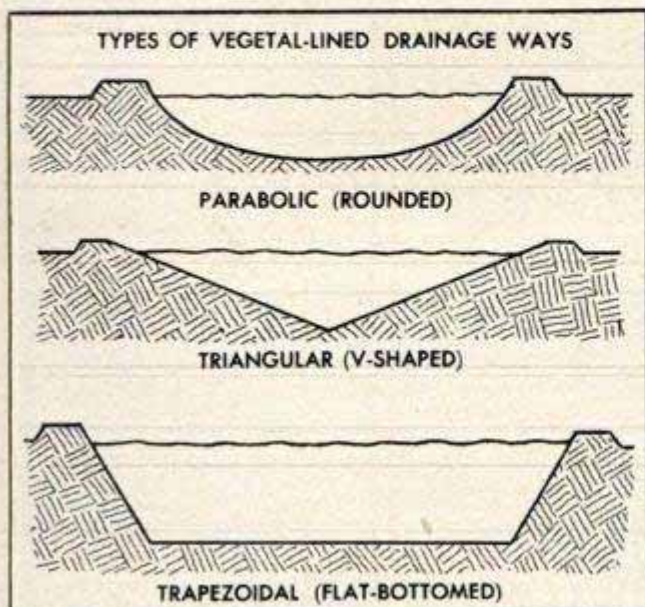
Out across one of the test channels rolls water at a rate of 75 cubic feet per second. The advancing crest has the characteristics of a roll-front flood wave. Measurements after the test will show the resulting erosion

starts to scour out the soil and carry it off.

Standard test procedure is to allow a steady flow of water to course down a test channel for 40 minutes. During this time surface observations are taken with point gauges (delicate instruments that measure in fractions of an inch). Before and after the flow, point-gauge measurements are made of the bed of the channel. The difference is considered scour or deposition—and gives an accurate measurement of the erosion processes at work.

Right, one of the research workers measures height and density of a clump of grass before flooding the channel. Diagram below shows various types of channels that can be built by a farmer on his own land

This information, recorded in tables, graphs and charts, might look like a foreign language to the average farmer. But it is the basis on which easy-to-read farm bulletins are prepared by the USDA. Farm advisers apply the results in sound, practical advice to farmers who wish to protect their land against erosion.



Concrete or asphalt-lined channels have proved to be the most efficient for carrying water. But they are too expensive for most farmers and act as a road block for farm machinery. Cheaper and more practical are broad, flat watercourses which can be crossed easily by tractors and animals and on which can be grown a hay crop. They are usually constructed in three shapes; parabolic (rounded); triangular (V-shaped); and trapezoidal (flat-bottomed).

Getting a grip on the earth with grass and other vegetal material seems to be the secret of defeating soil erosion. When an area is naturally wooded or protected by a good cover of grass, drops of rainwater strike branches and leaves, shattering into a fine spray which is absorbed by the soil and humus with blotting-paper action. In addition, roots help hold the earth in place.

But when there is no such protection and raindrops strike the bare earth, the action dislodges tiny particles of soil. From then on it's like a snag in a pair of stockings. The muddy mixture, obeying the laws of gravity, begins to flow downhill. First a rivulet, then a brook, and finally a river, the moving water gouges out great hunks of good topsoil.

Two hundred years ago erosion problems in this country weren't serious. Much of the United States was covered with virgin forest and the great plains of the Mid-

dle West were knee-deep in grass. But as the American homesteader moved toward the west, he cut down the forests and plowed the land. The climax was the tragedy of the dust bowl in the 1930s followed by the destructive spring floods of 1947.

Finding the right grasses to hold down America's barren acres is the second phase of the Outdoor Hydraulics Laboratory research program. Ree and his men have had to become botanists and agronomists as well as engineers. The ideal grass should furnish a complete cover as quickly as possible, not become a pest in adjacent fields, and must be able to withstand erosion.

Tests were made with approximately 25 different grasses including such well-known varieties as Bermuda grass, centipede grass, Kudzu, sericea, common lespedeza, redtop, Italian rye grass, weeping lovegrass, buffalo grass, Sudan grass, Kentucky blue grass, brome and King's Ranch strain yellow bluestem. Although the search for an ideal grass continues, the best so far seems to be Bermuda grass—sometimes called "devil grass" or "wire grass." Back-yard gardeners who discover it in their petunia beds sometimes call it even more unmentionable names.

One of the test channels containing Bermuda grass planted in silt loam was subjected to 13 hours of continuous flow of

(Continued to page 260)



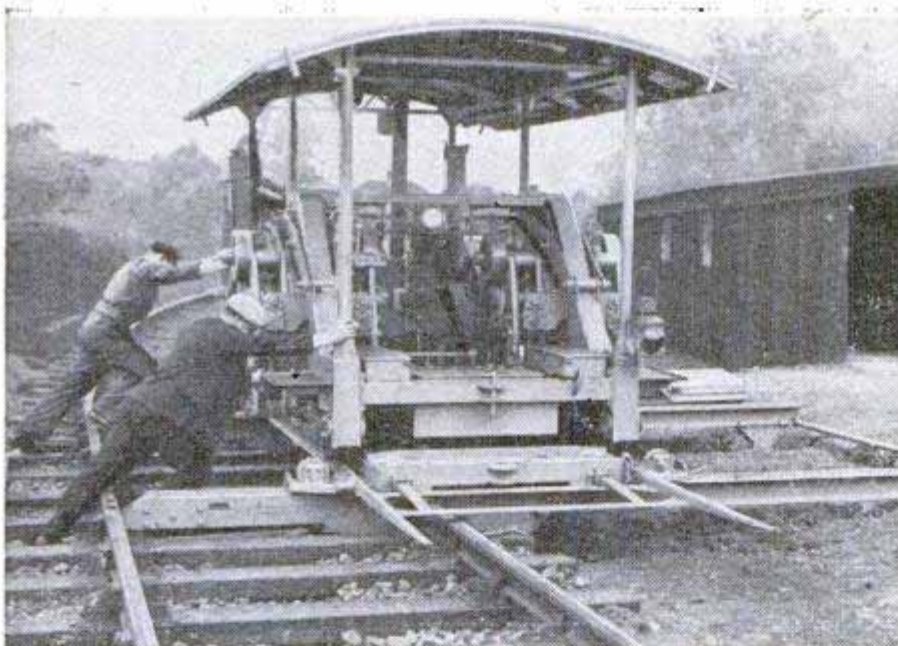
Engineer adjusts current meter prior to checking the speed of the water, a measurement necessary in comparing tests

Grain Harvester "Mines" Lead

They're "mining" lead with a grain harvester on a five-acre tract near Kansas City, Mo. The lead is in the form of millions of shotgun pellets and it's being mined on a skeet range owned by Russ Elliott, who harvests an average of 8000 pounds a day. Elliott found that it would be too expensive to use city water in separating the pellets from the dirt. Last year he hit on the idea of using a grain harvester or combine to blow the dirt away from the lead. He located a screw-feed model and removed all the grain-handling equipment. Two men now mine the gun range, shoveling $\frac{3}{4}$ inch off the surface into the

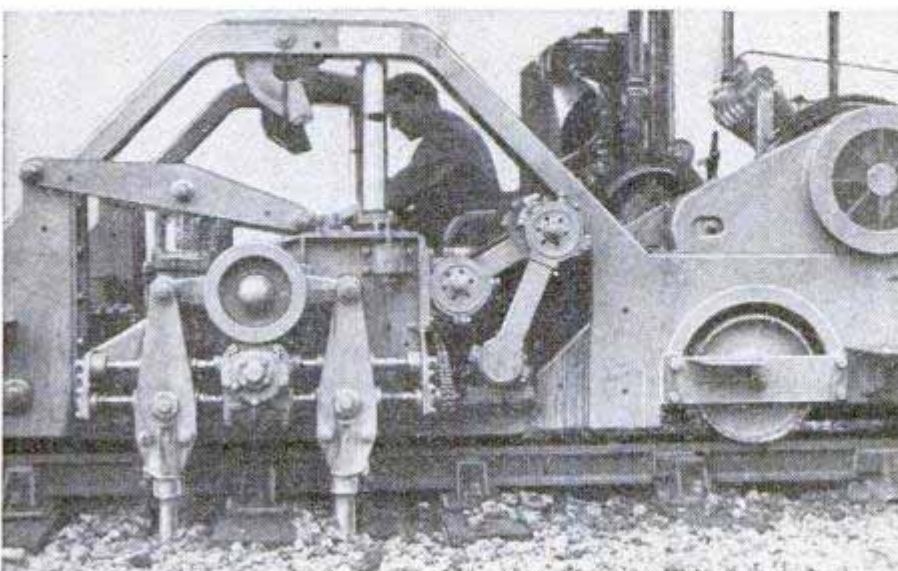


combine. So far Elliott has harvested more than 100 tons of lead. He has recovered less than half the lead on the range—and the sportsmen are still shooting.



Gravel Tamper Levels Rail Ties

Developed by a Swiss manufacturer, a machine forces ballast under railroad ties to level the track. Much time and shovel work are saved as the device performs its job at the rate of four ties every 15 seconds. The machine, called a Matisa, is used by the London North Eastern Railway. Even though it weighs about eight tons, it can be pushed off a track in a few seconds. With two or three men pushing the Matisa, a derailer is used to steer it off the tracks.



Top, the eight-ton machine can be pushed off the rails by two men to make way for a train. Bottom, tampers force ballast under four ties every 15 seconds

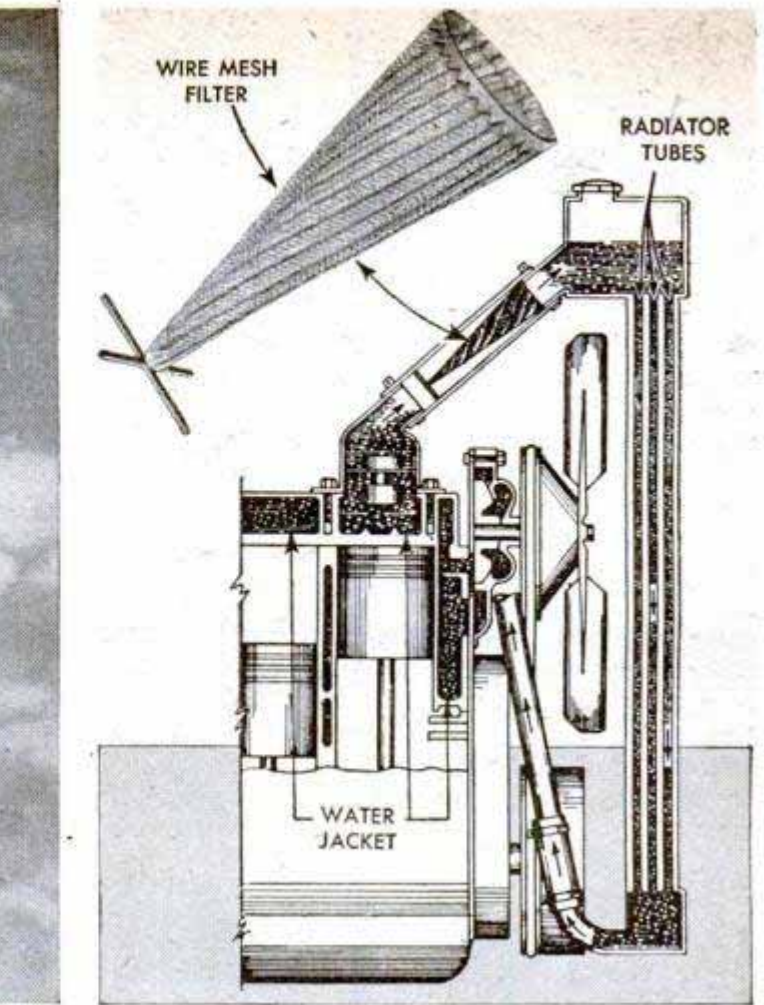
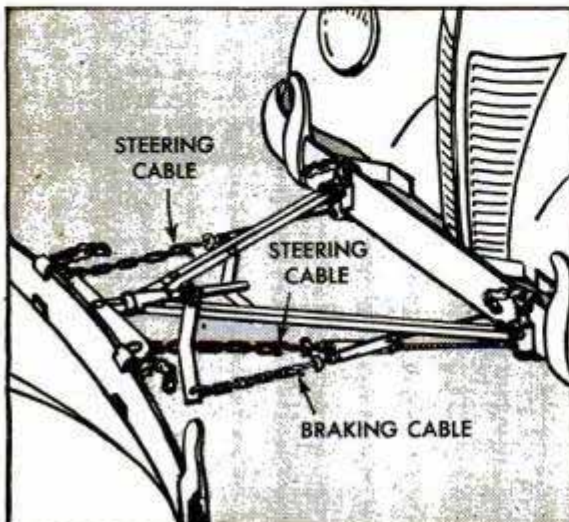
Streptomycin, the drug that successfully combats several infectious diseases in humans, kills certain types of germs that cause blight in plants, it was revealed in tests at the University of California.



Emergency Gasoline Can Has Attached Hose

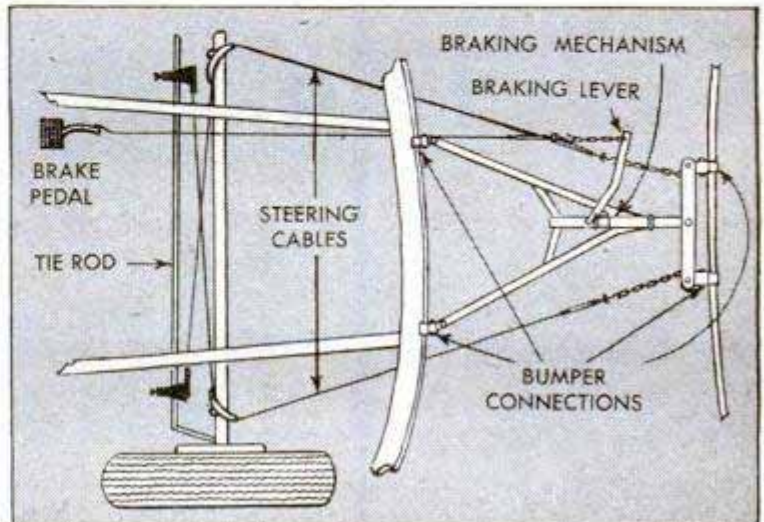
Extra gasoline for emergencies can be safely stored in a can resembling an overnight bag. It measures 6½ by 9½ by 17 inches, low enough to stow beneath boat seats and in auto trunks, and holds 2½ gallons. When not in use, a flexible pouring hose, shaped to fit in a grooved channel in the can, returns automatically to the top and covers the air vent.

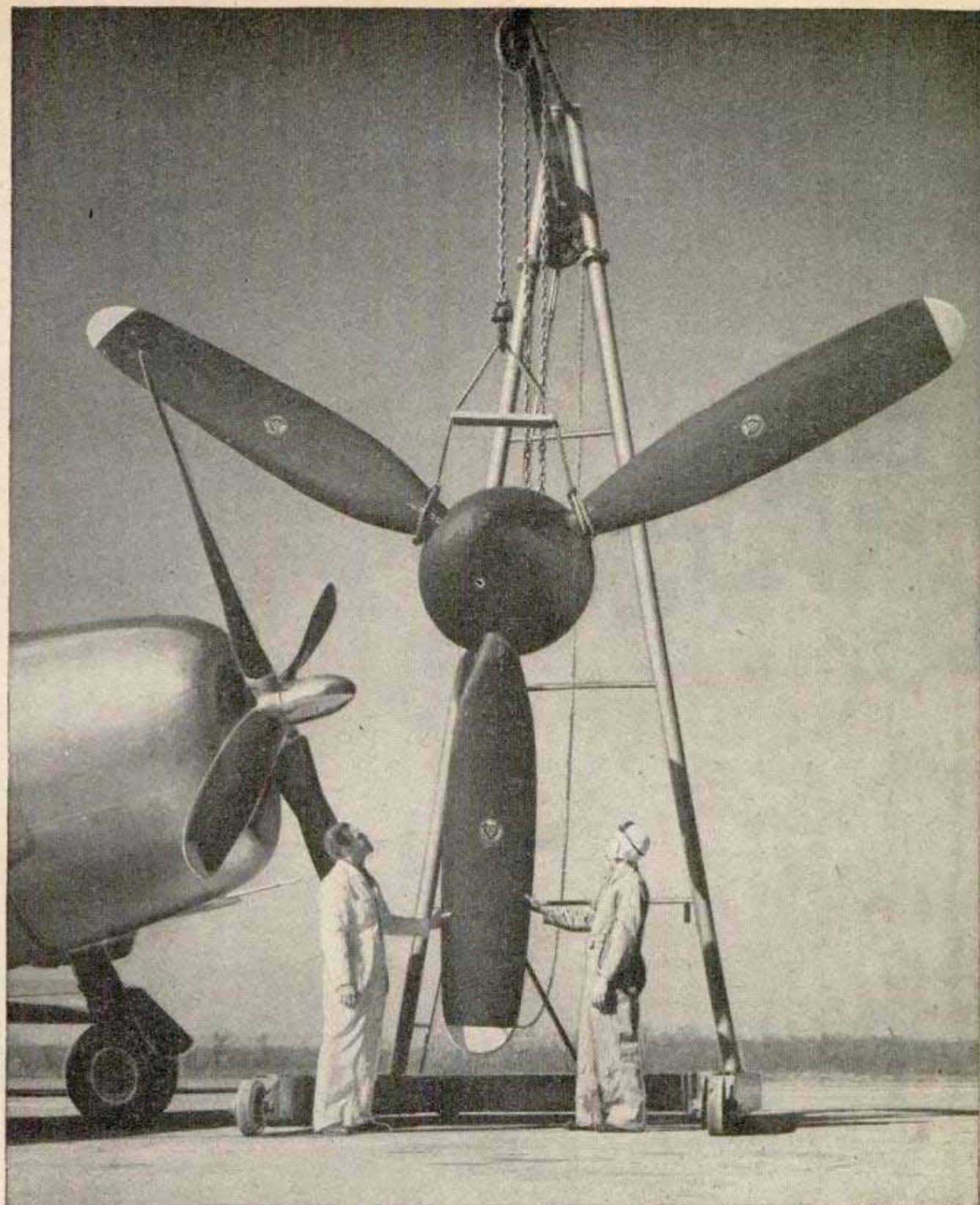
AUTOMATIC TOW BAR enables one driver to steer and apply the brakes on two vehicles simultaneously. Clamped on the cars' bumpers, the tow bar has two cables that operate the tie rod of the towed vehicle. Braking is accomplished when the tow car slows down causing pressure on the tow bar which moves a braking lever and applies the rear car's brakes. For reversing, an adjustment has to be made to disconnect the brake lever



Filter Keeps Auto Radiators Clean

Rust and scale are kept out of auto radiators by a cone-shaped wire mesh filter that fits in the cooling line. Large particles from the water jacket are trapped as they move up from the motor to the radiator tubes. Pieces small enough to pass through produce a scouring action inside the tubes. The inverted cone's spiral design causes a swirling action that retards clogging and consequent reduction of the flow.





Curtiss-Wright photo

Not a last look, insists the author. Six of these 19-foot propellers pull the world's largest landplane, the XC-99, through the air. Blades' pitch can be reversed to brake landing run

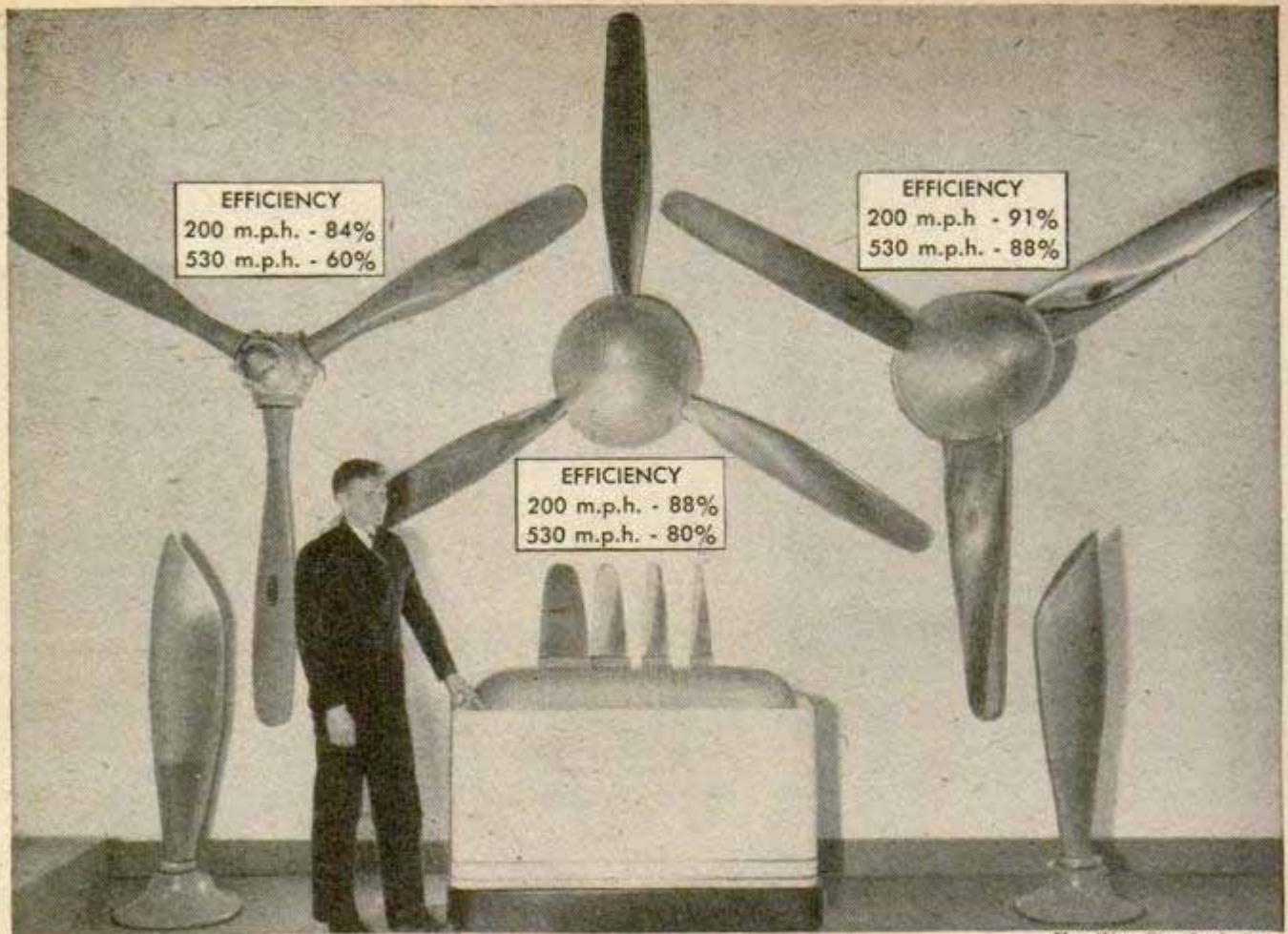
Has the Propeller a Future?

WHEN JET PROPULSION was developed, hasty critics of old methods said the propeller was on the way out.

Yet today, engineers are readying a fantastic array of multiblade props and believe-it-or-not blade shapes that will make

By William Winter

it possible for propeller-equipped planes to penetrate the dread transonic region of "perpetual storm," from 600 to 700-odd miles an hour, where the spectre of split-second destruction of an airplane haunts its designers. When answers to this problem are found,



Hamilton Standard photo

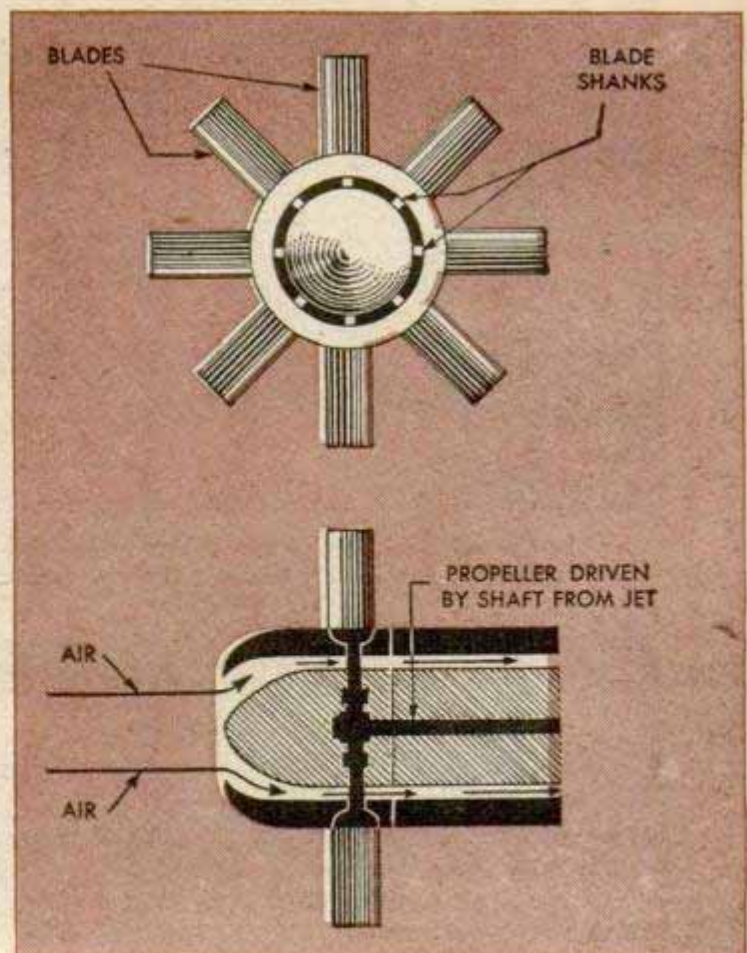
the same basic airscrew device that pulled the Wright brothers' craft through the air is expected to be capable of supersonic speeds of at least 800 miles an hour.

In the propeller man's bag of tricks are future "fans" as big as 30 feet in diameter—special wind tunnels have been devised for possible propellers of 40 feet; eight and ten-bladed props that look like blowers; or props with abbreviated triangular blades. Some propellers won't even look like propellers, as we know them today.

Propellers are subject to the same high-speed teething troubles as airplanes. Fast-flying planes encounter "compressibility" effects where the air no longer streams smoothly over the surfaces of the ship, but slants off in shock waves like the waves from the prow of a motorboat. As 700-mile-an-hour speeds are approached compressibility plays gremlin tricks with the controls and will buffet any ordinary airplane to pieces. So the designers are working up strong knife-thin wing sections and wings of many strange shapes or planforms. Some are "delta" shaped like paper darts. All these difficulties were appreciated years ago by propeller engineers who necessarily must work five years or more in advance of projected airplanes.

The compressibility problem, with its abrupt changes in forces, is now believed to extend beyond the transsonic region. In

In propellers hanging on the wall, note progressive gains made by running widest section of blade into spinner. Below, drawings of an eight-bladed prop and double spinner for gas turbines of the future

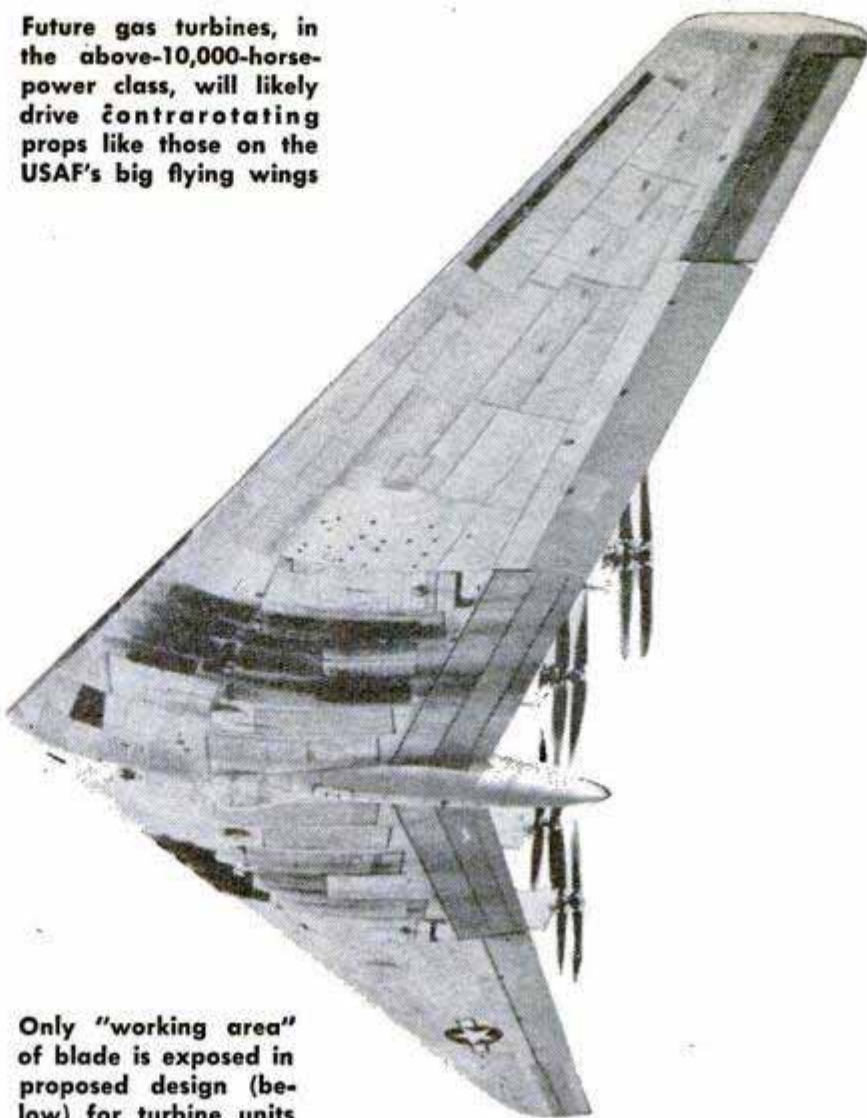


other words, it is doubtful that flight at supersonic speeds would be less rough than in the transsonic range.

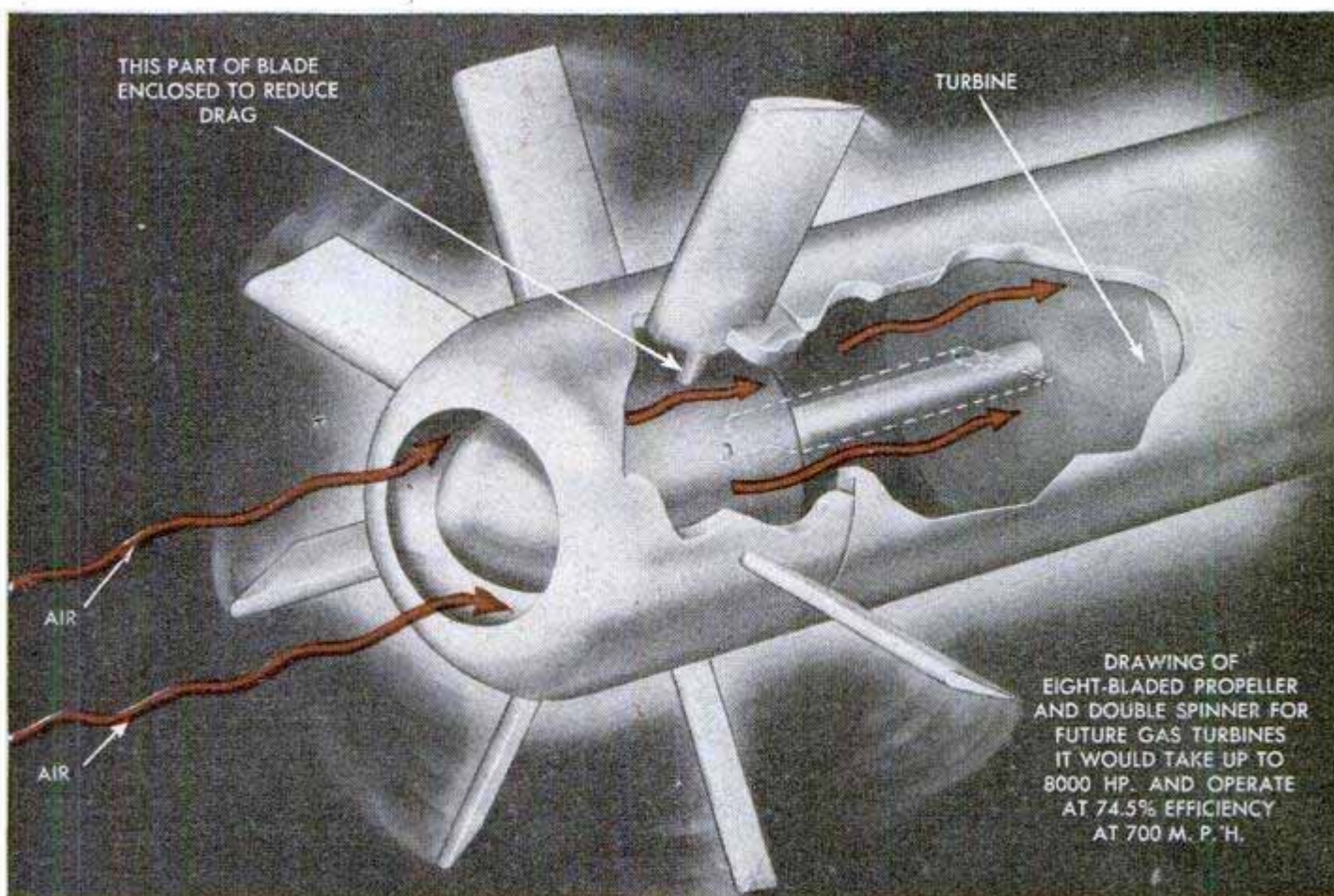
For years many propellers had been operating with blade-tip speeds of as high as 650 miles an hour. When a Flying Fortress cruises, its propellers whirl with a tip speed of a bullet fired from a 45 Colt automatic! Charles M. Kearns, assistant chief engineer for Hamilton Standard, believes the present square-tipped paddle blade, which closely resembles the vanes of a Dutch windmill, will absorb at least 10,000 horsepower and be capable of speeds up to nine tenths the speed of sound, or close to 700 miles an hour.

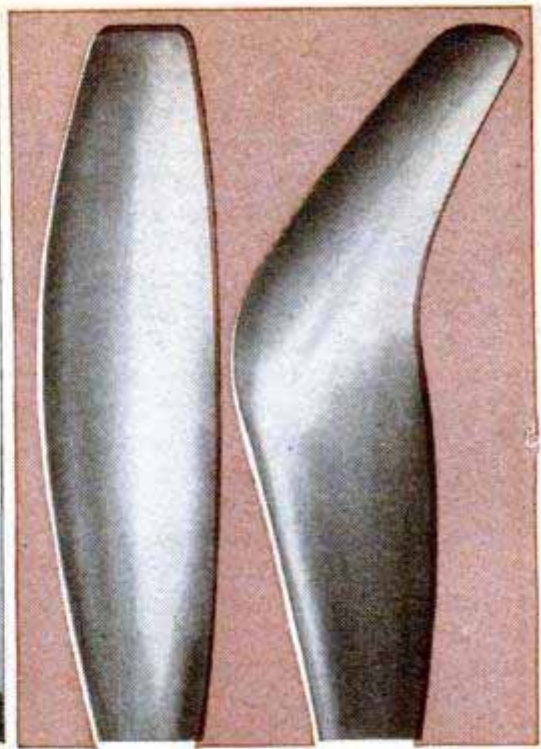
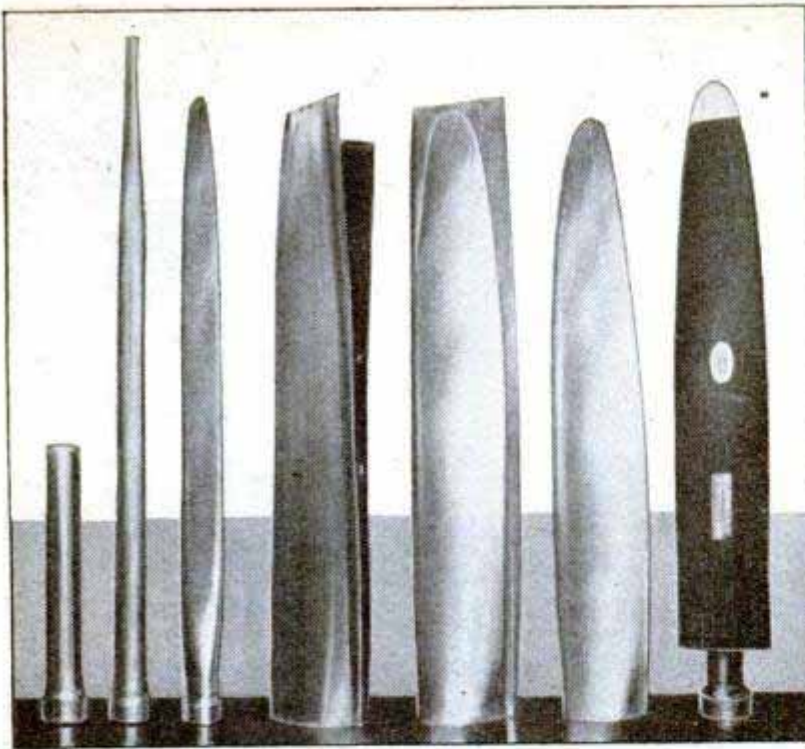
At present, the counter or contrarotating propeller, in which two sets of blades are arranged in tandem with one set revolving clockwise and the other counterclockwise, is considered heavy and complex, but in the future it will be seen on turbines of 10,000 and even

Future gas turbines, in the above-10,000-horsepower class, will likely drive contrarotating props like those on the USAF's big flying wings



Only "working area" of blade is exposed in proposed design (below) for turbine units





Above, steps in making hollow-blade propeller. Core at left fits inside sheet-metal-formed blades. Black sponge-rubber fill, shown in cross section at right below, prevents thin walls from "breathing." Above right, even slight distortions of blade's shape can often increase its efficiency 5 to 10 percent or more



20,000 horsepower. New blade shapes and other tricks will certainly take everything that such super power plants will dish out.

Chief among the early headaches was the fact that propeller-blade-tip speeds could not be further increased without serious losses in efficiency. Propeller usefulness seemed limited to 400-odd miles an hour. One difficulty was the steadily mounting power of new engines, another the great increases in airplane speeds that had the effect of stepping up blade-tip speeds disastrously. Bigger props were nec-

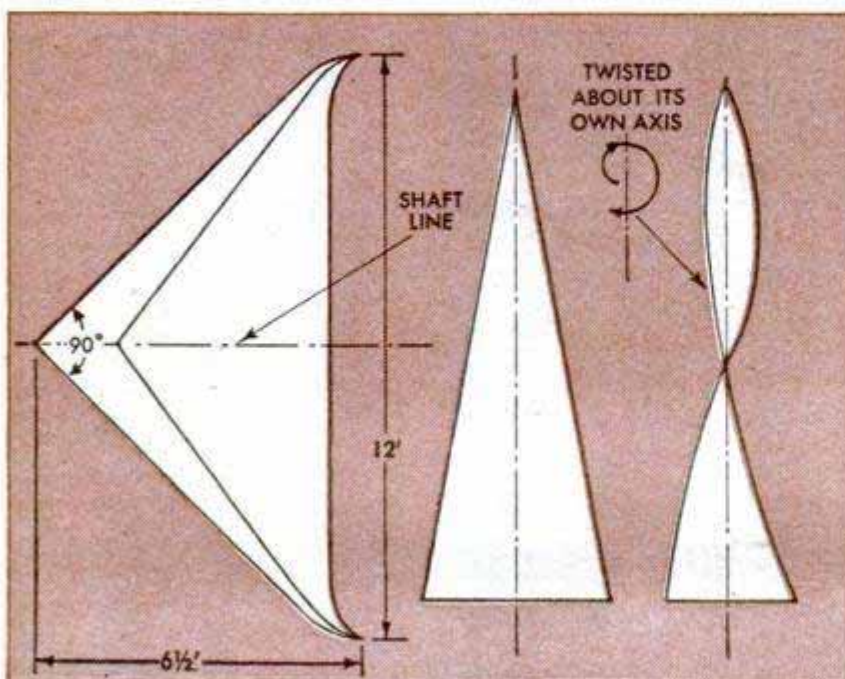
essary, but that meant greater tip speeds.

One solution was gearing down engines to revolve propellers more slowly, as on the Boeing B-29 bomber. Soon more and more blade area was being added to propellers, so much so that manufacturers had to find radically new ways of making lighter props. The hollow steel blade resulted. For the moment these massive, but light, propellers can handle the power problem at speeds up to 500 miles an hour or so. But sensationally fast fighters and bombers loom on the horizon and for them entirely new prop designs may have to be developed.

The National Advisory Committee for Aeronautics found that the ordinary three-bladed propeller has an efficiency of 84 percent at 200 miles an hour, but is only 60 percent efficient at 530 miles an hour. Simply by adding a spinner to streamline the hub section of the propeller, and by concealing part of the round blade shanks within the spinner,

(Continued to page 248)

Side view of another propeller shape under study. It is a triangle twisted about its own axis. It will take up to 18,400 hp. and be 74.5 percent efficient at about 700 miles an hour

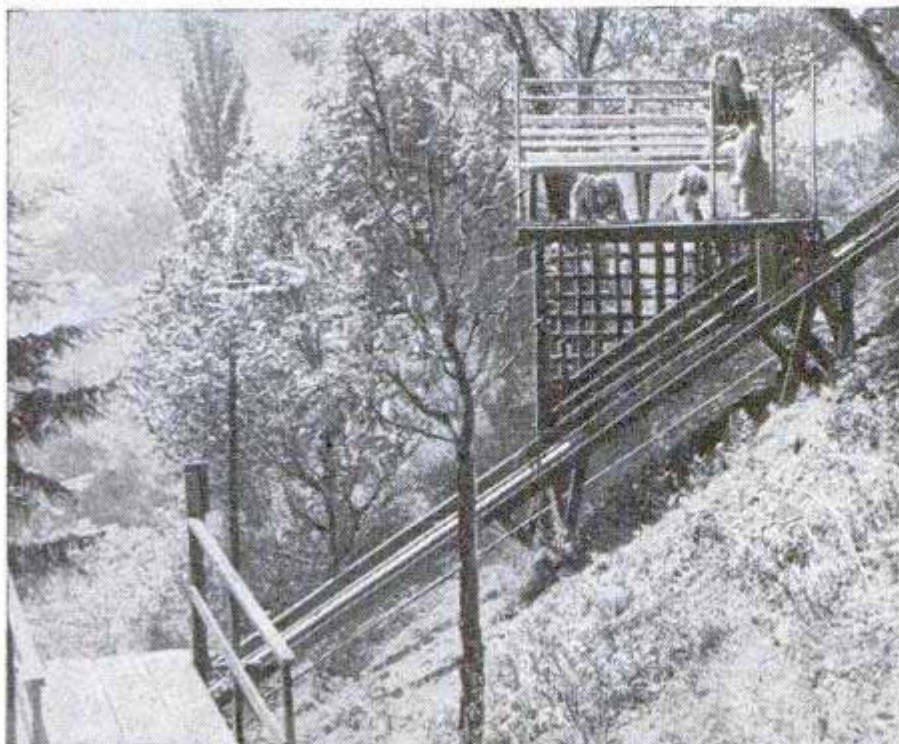
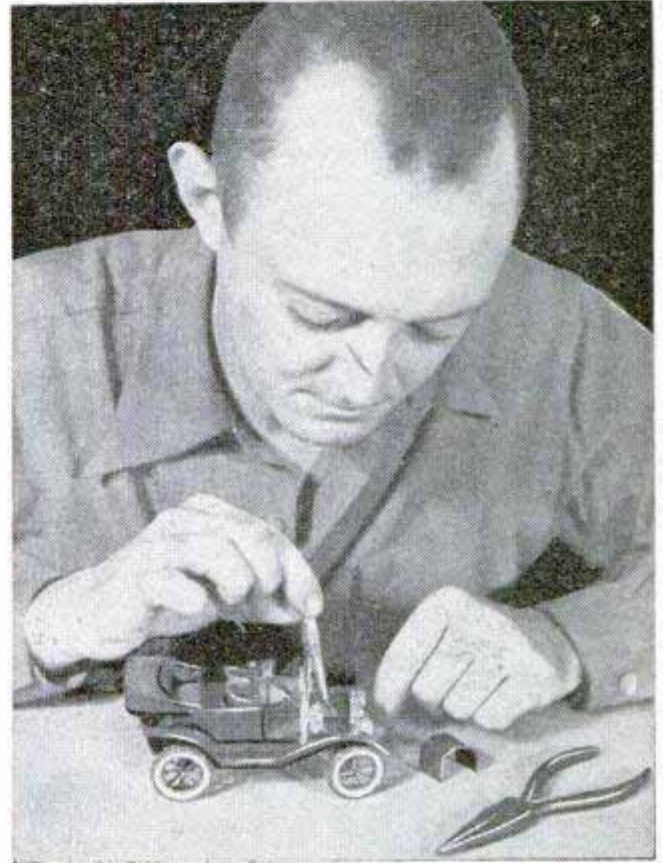




Model-T Modelmaker

Model-T Fords, with emphasis on the "model," are the hobby of C. B. McKennan of Clarksville, Ark. McKennan spends his spare hours building models of early Fords, complete even to keys in the ignition switches. The wheelbase of each car is five inches and the wheels, which will turn, have tin bearings to prevent stiffening in damp weather. Springs are made of clock springs, giving the models a realistic bounce when they are pushed. The steering system is an exact copy of the original and the fan revolves under the removable hood when the crank is turned. Only the frame, differential and motor are made of wood. The body, fenders, and hood of each model are cut from tobacco cans. Each interior is complete to a brake, clutch, reverse pedal, emergency brake and upholstery made of cloth. The headlight lenses, windshields and window panes are made of celluloid. McKennan already has built models of a 1927 pick-up, 1922 coupe, 1912 touring car, 1915 roadster and 1925 touring car. Eventually he hopes to make a model of every style of early Ford that was manufactured.

↑ Models include, left to right, '27 pick-up, '22 coupe, '12 touring car, '25 touring car and '15 roadster. Below, McKennan overhauls "engine" with tweezers



Hillside Elevator

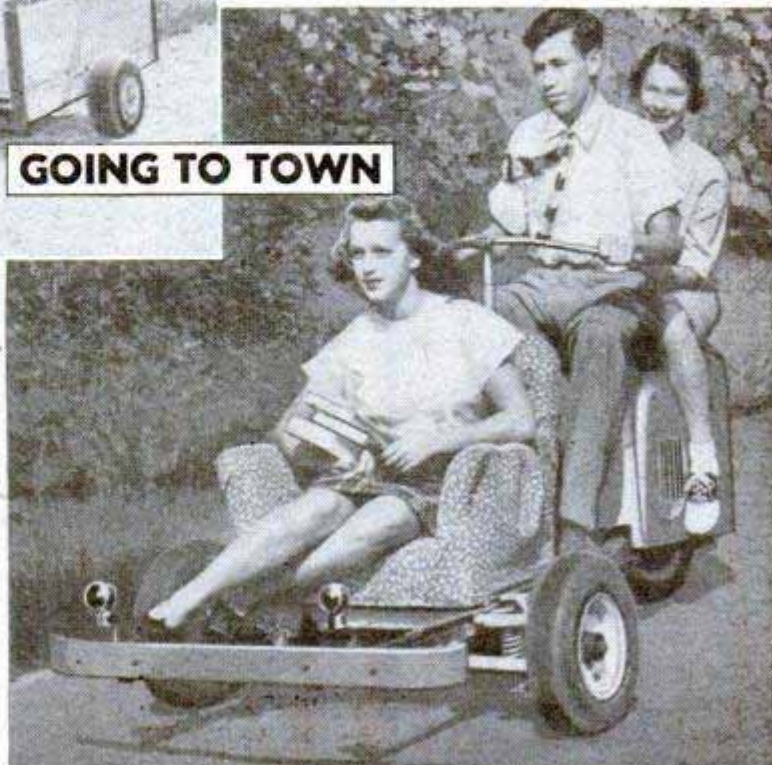
Built of Army-surplus material, a small cable car with an 850-pound capacity provides an easy way of getting from the garage to a hilltop house in California. The car is pulled up the 145 feet of 50-percent grade by a three-horsepower electric motor geared through an Army-truck winch. Flanged wheels run on an angle-iron track. As a counterbalance, a smaller car made of a 600-pound iron slab runs on rails between the main tracks. If the motor fails, the high gear ratio of the winch stops the car.



GOING TO TOWN

↑ Car, truck and tractor—that's the role performed by a garden tractor specially equipped by Brooke Burnham of Cherry Hills Village, Colo. When his wife needed transportation to and from the village store he attached a cart to the tractor with a length of gas pipe. Now Mrs. Burnham sits at the front of the cart and drives the tractor to town on shopping trips while her children sit inside the cart. On the return trip the cart serves as transportation for the family purchases. The tractor travels only two miles an hour but, according to the Burnham family, that's better than lugging packages a few miles from the store to their home. Conversion cost was \$8.00

↓ Ray Strater's scooter car has everything in riding comfort, from an upholstered lounge chair to a "rumble seat." The forward passenger can use the bumper as a footrest. An extremely sparse gas user, it was the Mayfield, Ohio, high school boy's solution to the transportation problem. The teen lizzie has coil springs and lights



Spray Cleans Paint On Exterior Walls

Dingy, soot-covered house paint is cleaned without scrubbing by a spraying unit that pumps a chemical solution through a garden hose. The solution loosens surface dirt and dead paint and rinses them away uncovering clean, bright paint. It does not harm good paint, nor will it damage lawns and shrubbery. Pressure is provided by a pumping unit that connects to water and electrical outlets. Chemicals are placed in the tank of the unit where they are mixed with water.

Ⓞ A new record was set when a parachute carrying scientific instruments was released from a rocket at an elevation of 59 miles.

Popular Mechanics is always ready to supply further information to readers about various products described in any issue. Just write Bureau of Information, Popular Mechanics, 200 East Ontario St., Chicago 11, for quick reply

The CRAFTSMAN

★ To complete that Christmas tea service for the young hostess, we offer a folding table-and-chair set of exclusive design. We've tried to keep Dad's problem in mind, too, by making it easy to build. The story on page 178 goes into all details of making the set from plywood, large dowels and hardwood scrap.

★ If you like to see things take shape try basket weaving, page 201. It's one of the oldest of the handicrafts and still one of the most popular and profitable. Weaving materials can be purchased ready to use or you can prepare them yourself.

★ With a dozen or more rare old coins in your collection you'll feel more at home among collectors if you display them in a plunder chest. On page 190 you will find two designs in fine hardwoods.

★ For the shop man as well as the home workshop fan, a story on page 224 explains the dowel joint, its uses and how to make it.



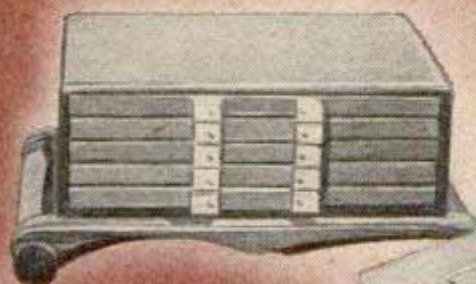
DOWEL JOINTS



BASKETRY



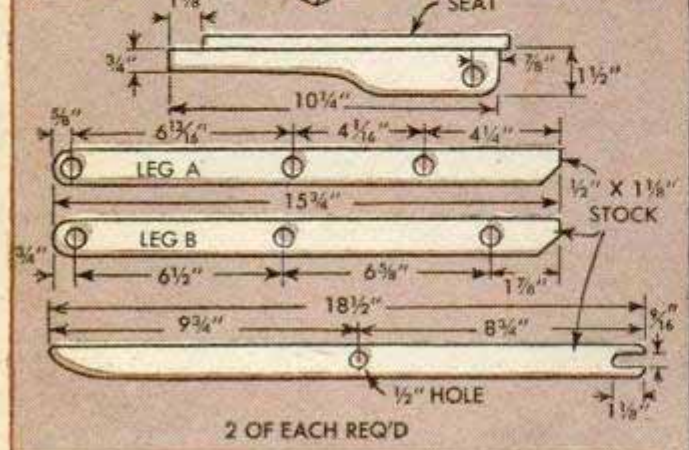
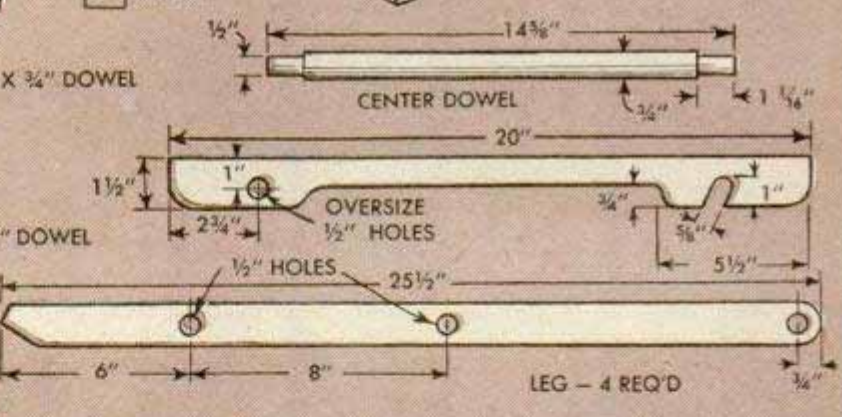
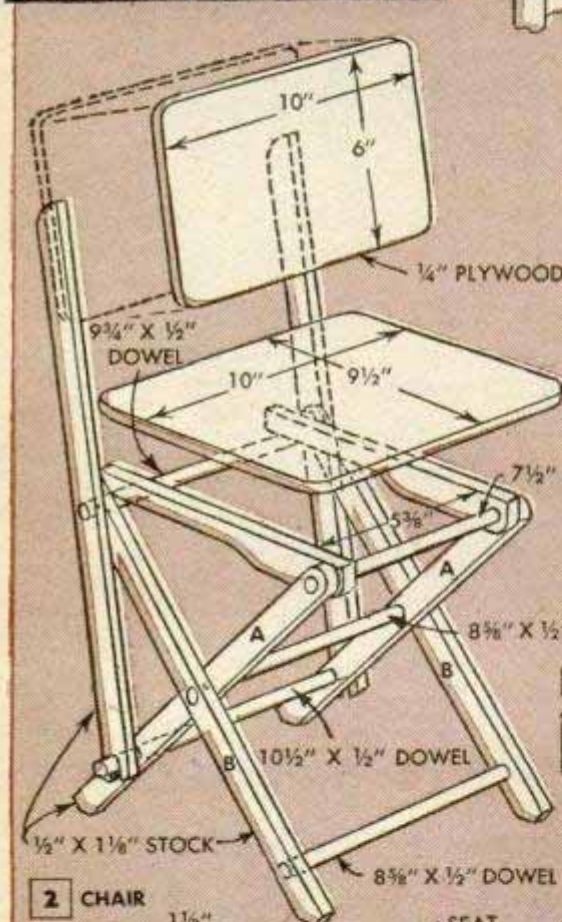
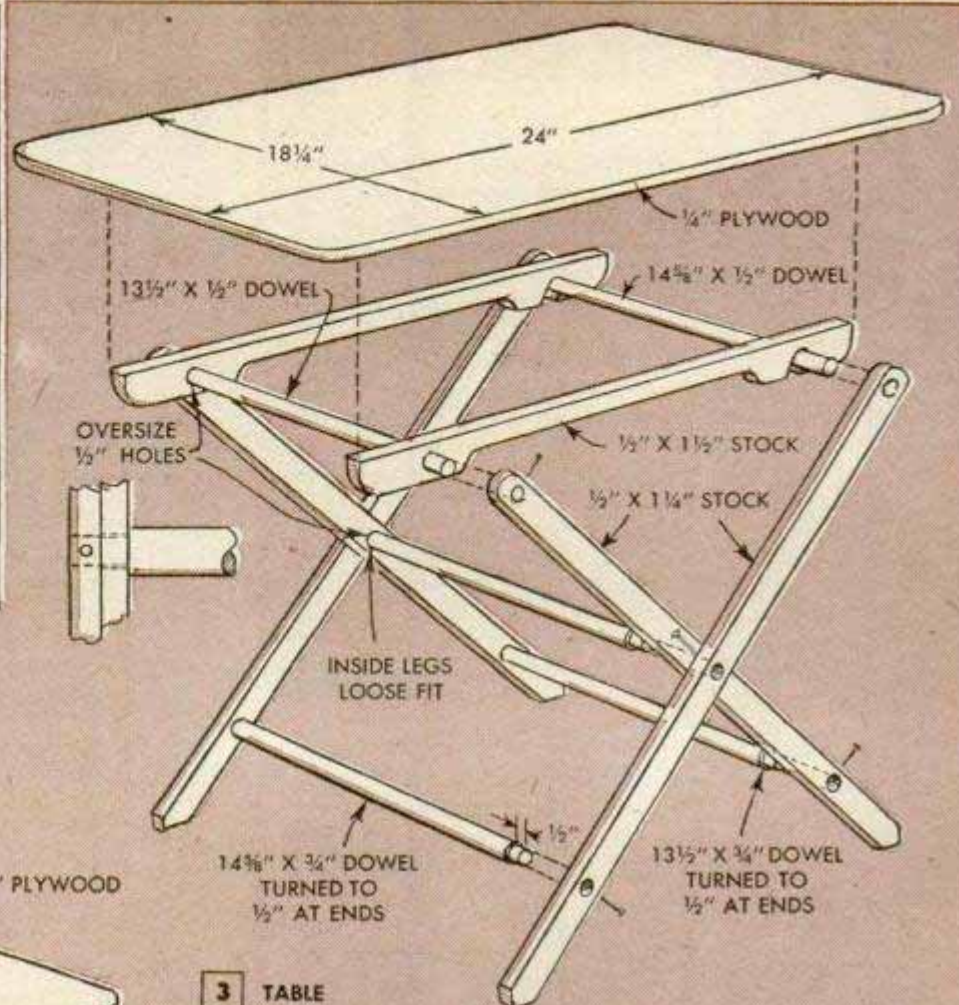
CHILDREN'S TABLE
AND CHAIR SET



COIN COLLECTOR'S
BOXES



CHILD'S FOLDING TABLE AND



CHAIRS

Just the thing to make her Christmas set of dishes complete. Table and chairs fold compactly for storing

TEA PARTIES galore are in store for the little hostess of your family when she can entertain with this novel table-and-chair set. It is lightweight and folds as in Fig. 5, so that little tots can carry it easily. Very little material is required to make it.

The chairs: Any number of chairs can be made. Several duplicate parts can be cut and drilled at one time, Fig. 6, and if power tools are available, a setup can be used to mass-produce the parts quickly and uniformly. Fig. 2 details the assembly of the chair and the plan below it gives the size of the members comprising the framework. Note that the stretchers are standard dowel stock and are purchased ready-made. With the exception of the seat board and back rest, which are plywood, all parts are of $\frac{1}{2}$ -in. stock. Leg and back members are $1\frac{1}{8}$ in. wide, while the seat supports are shaped from stock $1\frac{1}{2}$ in. wide. Notice that the ends of the stretchers fit flush with the outside faces of the legs and that the lower rear one extends through the back legs about $\frac{7}{8}$ in. at each end, over which the notched back members hook. Except where the parts pivot, all stretcher holes should be bored for a light press fit, the others being made slightly oversize. In the

Here's how compactly the table and chairs fold. This is a welcome advantage in the home where storage space is limited. Set can include two or more chairs

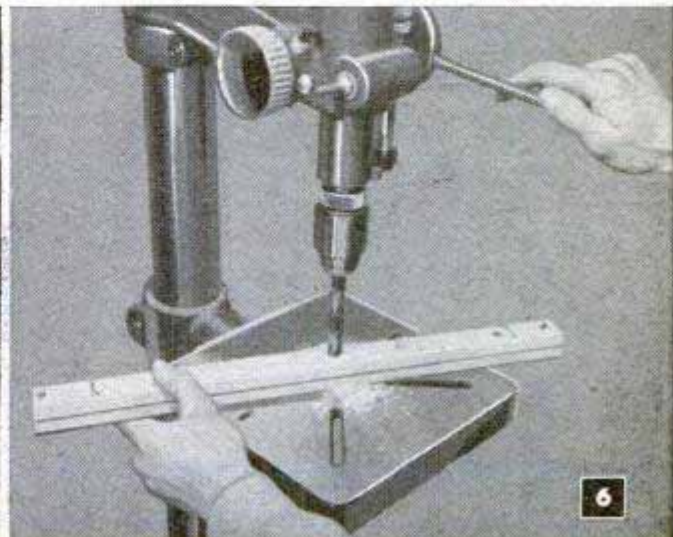
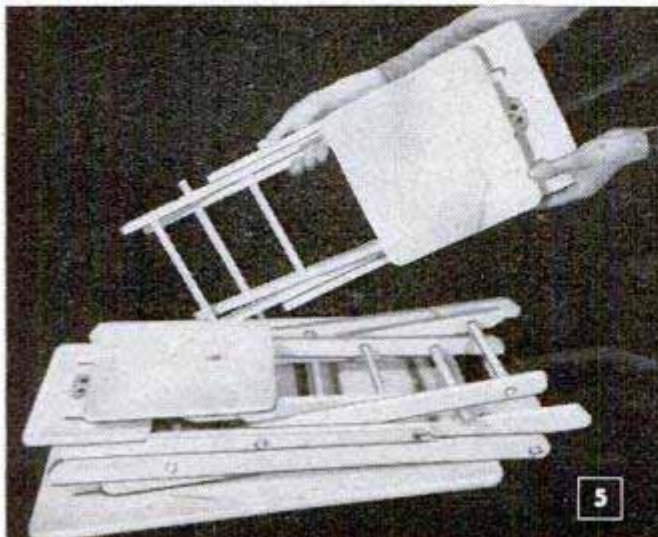


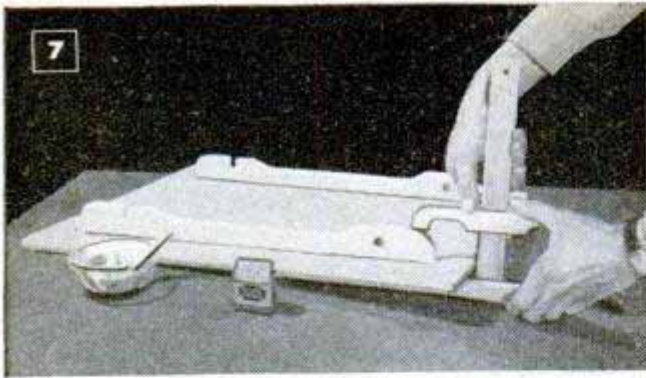
By Richard Hanscom

latter case, the holes can be enlarged for a sliding fit with a round file or sandpaper wrapped around a smaller dowel. In assembling the parts, allow sufficient clearance between the joints. It's a good idea to use a metal or cardboard washer to prevent rubbing of the painted surfaces. Nails are driven crosswise through the legs and into the stretchers where indicated.

The table: Construction of the table is similar to the chairs. Fig. 3 shows how it goes together, and also gives the size of the parts required. Note that the stretchers are turned down at the ends to fit $\frac{1}{2}$ -in. holes in the legs. This adds rigidity, but, if desired, you can simply drive them into undersize holes and pin them. The top and its underframing must be ready for assembly at the same time as the other parts. The holes in which the top pivots are made

Where a number of chairs or several complete sets are to be made, cut and bore duplicate parts by mass-production methods, using simple jigs made of wood

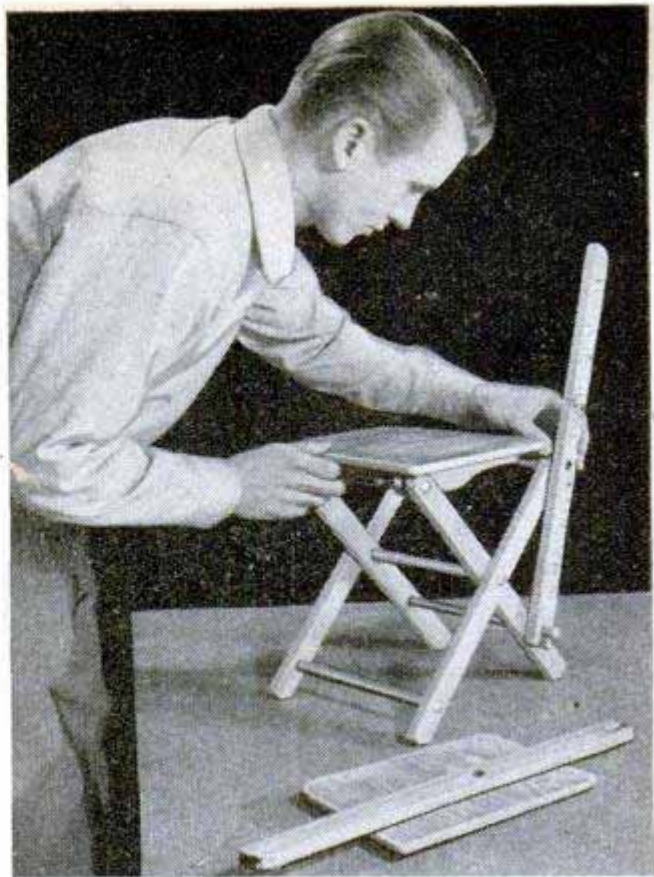




Above, clamping the underframing to plywood table top. Left, testing workability of chair before dismantling it for finishing. Spray gun speeds painting

oversize, and the notches at the opposite end are formed by first drilling $\frac{5}{8}$ -in. holes and then sawing in from the edge at an angle to meet the holes.

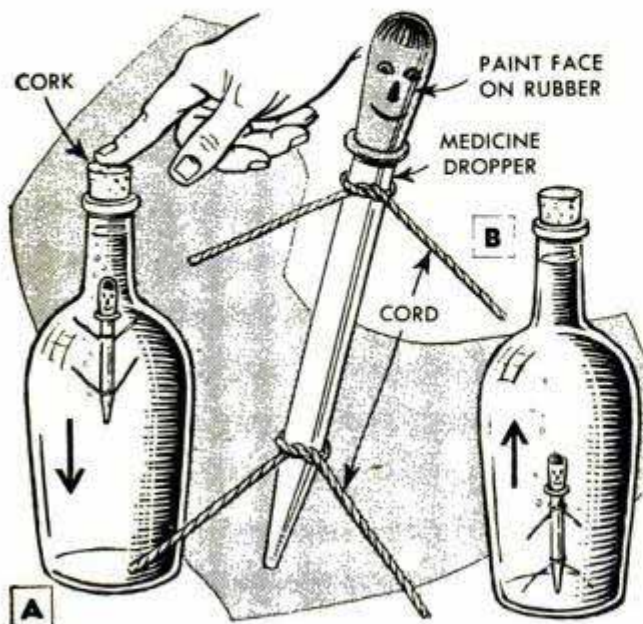
Finishing: The parts can be painted easily if done before assembly. Check to see that the chairs and table fold freely and then dismantle for finishing. Spray equipment turns the job into play and permits use of quick-drying lacquer. Give all the parts a coat of lacquer sealer first and when dry sand them lightly. Then finish with a couple coats of lacquer. Brushing lacquer is available but it requires considerable experience to apply. Very little brushing can be done and the lacquer must be applied with full brush loads in a sweep-



ing motion to avoid lap marks. Enamel, perhaps, is the best to use with a brush. The original set was done in light blue and striped in white as shown in Figs. 1 and 4. Decals can be added to the chair backs.

Law of Physics Is Demonstrated by "Diving" Medicine Dropper

The only equipment necessary for this amusing demonstration of Archimedes' principle is a medicine dropper and a bottle of water with a fairly long cork that fits loosely enough to act as a plunger. Paint a face on the rubber bulb of the dropper and tie short lengths of cord around the glass tube to simulate legs and arms. Use



180

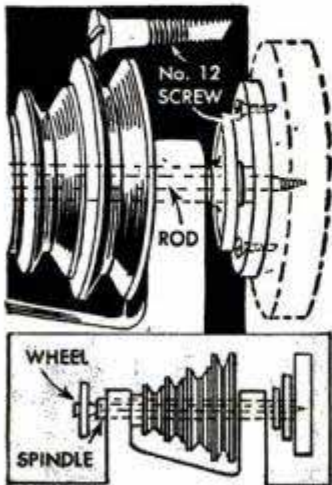
a large long-necked bottle filled with water well into the neck. Place the dropper inside the bottle. Twist the cork in the neck of the bottle until it moves easily, and press down on the cork. The dropper will descend slowly to the bottom of the bottle, A. Release the pressure on the cork and the dropper will rise to the top of the bottle, B. The dropper sinks because the air pressure inside the bottle is increased when the cork is pushed down, and since the pressure of the air inside the dropper remains the same, water is forced into the dropper until its weight is greater than that of the volume of water it displaces. Releasing the pressure on the cork, allows the air pressure in the bottle to decrease, and the air in the dropper expands. The expanding air forces water out of the dropper until it becomes buoyant and rises.

Monks' Cloth Reclaims Table Top

Table tops that are marred beyond the point of refinishing can be reclaimed by covering them with monks' cloth. Draw the cloth tightly over the top, tacking underneath, and apply a coat of varnish.

Wood-Lathe "Collet Chuck" Holds Faceplate Turnings

Handy in the home workshop for chucking a variety of faceplate work, this wood-lathe "collet chuck" also will work into a production schedule calling for rapid duplication of faceplate turnings. To make it,



es through the hollow lathe spindle and projects at both ends. File wood-screw threads on one end of the rod and key or pin a handwheel on the other end. To use, simply place the work against the wooden faceplate and draw up on the handwheel until the work is pulled tightly against the faceplate. The chisel-point screws will bite into the work and serve as dogs. On duplicate work it will save time to center-punch each turning.

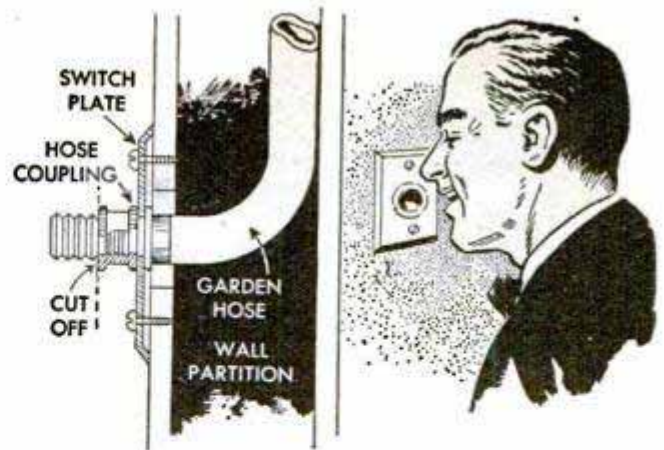
Russel I. Mann, Coopersburg, Pa.

Spring Catch Holds Drawer Closed



ble when the drawer is closed. Bend it from a strip of spring brass and mortise into the drawer side as shown, then attach with small flat-headed screws. As the drawer is closed, the hump bent in one end of the catch bears against the bottom of the drawer runner above. The spring can be adjusted so that a considerable pull will be required to open the drawer.

Wm. E. Danneman, Chicago.



Home "Intercommunication" System Utilizes Garden Hose

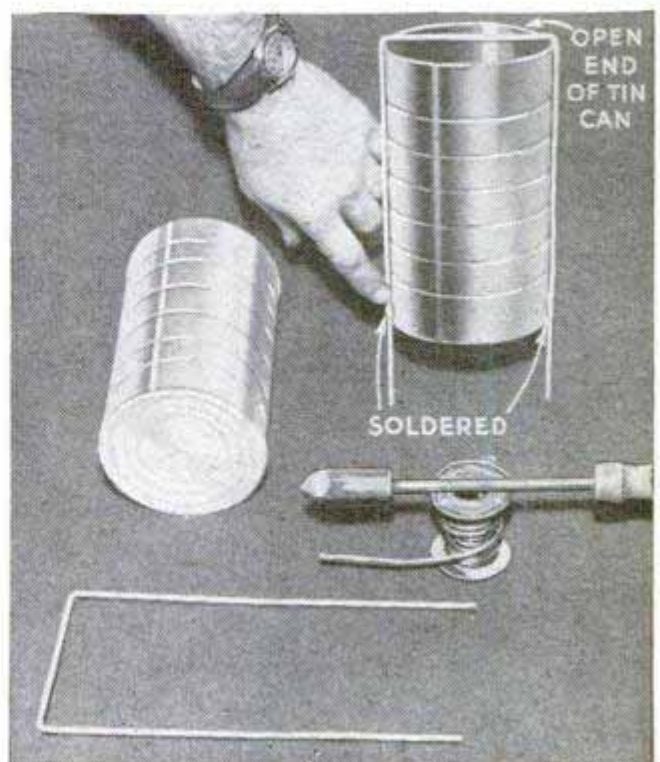
Talking from the basement to an upper floor of a house, from the house to an attached garage, or from any other separate point is easy with this simple speaking tube, which is nothing more than a length of garden hose. It should be run up through partition walls, the upper and lower ends of the hose being brought out through the walls as shown.

Gilbert M. Brueckner, Milwaukee, Wis.

Flower Holder for Use in Cemetery Made From Tin Can

An attractive nontipping flower holder for use on a grave can be made from a fairly tall tin can and a length of stiff wire. Bend the wire so that it extends over the top and down the sides, letting several inches project from the bottom to anchor the holder. Solder the wire in place and finish the can in a dark green color.

Ivan Grosvenor, Richmond, Ind.



Solving HOME

The small space behind a metal sash lock on a double-hung window makes it difficult to remove accumulations of dust and dirt with a cloth. To reach this inaccessible spot, try using a toothbrush with some scouring powder



The small screws holding together the parts of an electric-appliance plug sometimes work loose and the nuts become lost. This will not happen if sealing wax or stick shellac is applied to the nuts

If you prefer to dry a freshly laundered sweater in the sun, it can be hung outside on a line without stretching out of shape if it is suspended with a clean towel passed through the arm holes as shown

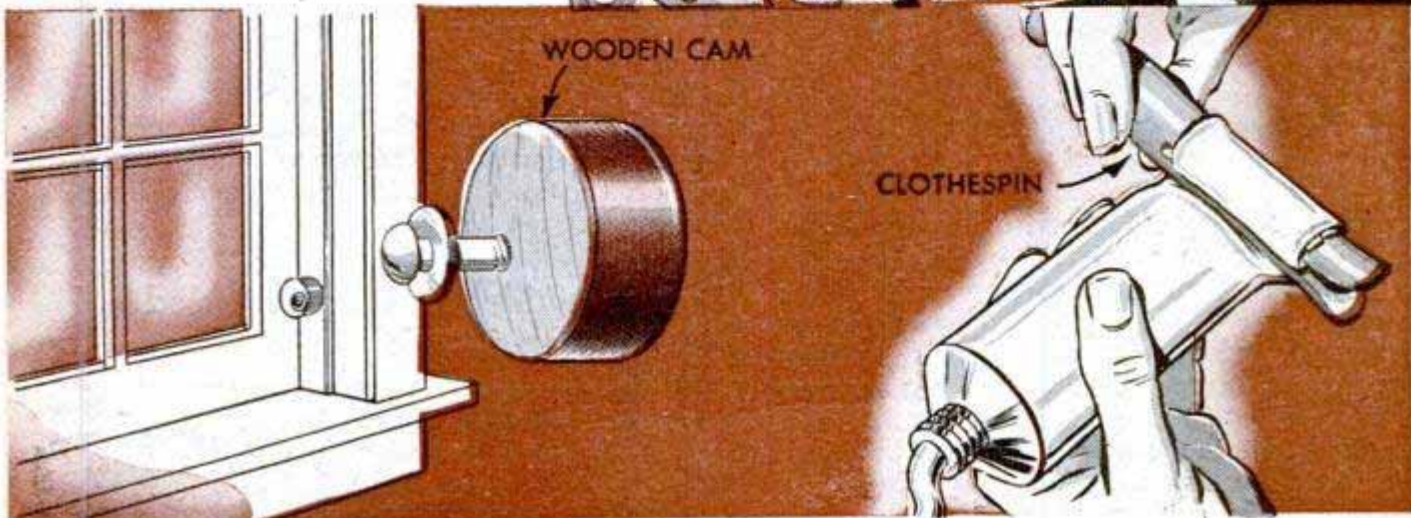
An old curling iron provides a good match holder to ignite the burner under a gas oven. The iron grips the match firmly and enables you to keep your hand out of danger should there be a minor flash of flame

If your potted vine needs a trellis, place a flat stick in the center of the flowerpot and attach several spring-type clothespins to it horizontally. Clip them alternately to opposite sides of the stick



PROBLEMS

A good way to hang odd pieces of broken mirror for use in the basement or garage is to frame the glass in a length of rubber hose or tubing and nail the ends to a wall. One side of the hose is slit lengthwise and triangular gussets are notched in the hose at points where a bend is made. The edge of the mirror is inserted in the slit hose



WOODEN CAM

CLOTHESPIN

To silence a rattling window, screw a small wooden cam to the stop in a position to bear against the sash. Make it of hardwood and drill it slightly off-center to provide a wedging action against the sash

Collapsible metal tubes containing toothpaste, shaving cream and other items can be emptied completely if they are rolled around a wooden clothespin. The pin is slipped over the tube and used like a key

Heat from a steam or hot-water radiator will be directed out into the room if you place a reflector between the radiator and the wall. A sheet of shiny tin, or cardboard painted aluminum, will do

This excellent pocket-type letter opener is made from a discarded hacksaw blade. First, grind off the teeth on the blade, then shape and sharpen a cutting edge at a 30-degree bevel on one end as shown

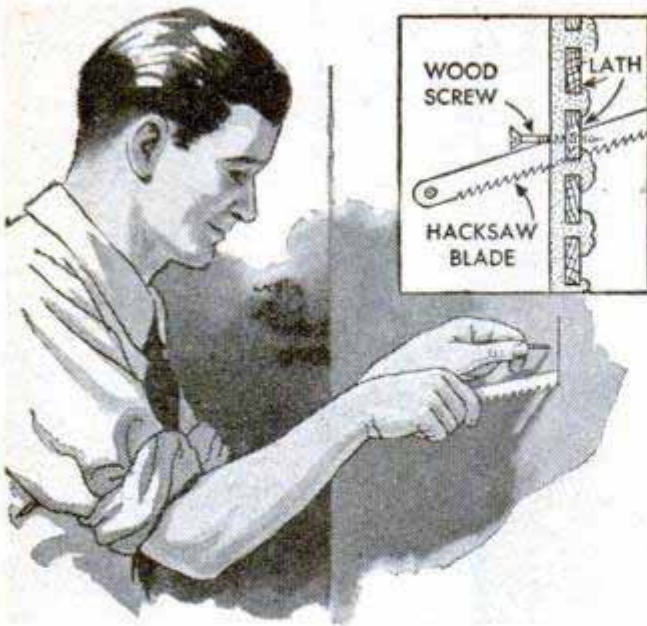


REFLECTOR

HACKSAW BLADE

PENCIL CLIP

How to Cut Holes for Outlet Boxes Without Cracking Plaster



When cutting a hole in a lath-and-plaster wall for an electrical outlet box, the lath will frequently break away from the plaster and cause it to crack or become loose. One electrician avoids this by driving a wood screw into a lath at the approximate center of the hole to be cut. Then, pulling on the screw to hold the lath against the plaster, he cuts the hole with a hacksaw blade. The blade is held so the teeth make the cut on the pulling stroke.

Harold M. Freeman, Clinton, Iowa.

Cloth Basted by Using Tape

Instead of using thread to baste two pieces of cloth together preparatory to stitching the seam, my wife finds that she can save much time by using strips of masking tape for this purpose. The strips are applied across the seam and as close to-

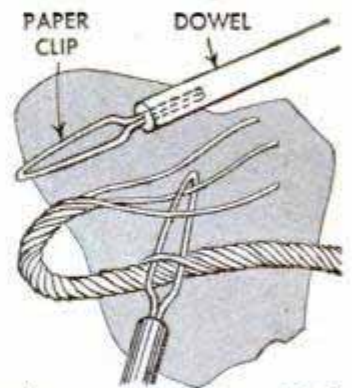


gether as required to keep the edges together. When sewing the seam, the tape strips are removed ahead of the sewing-machine needle, one at a time.

Frank Shore, New York City.

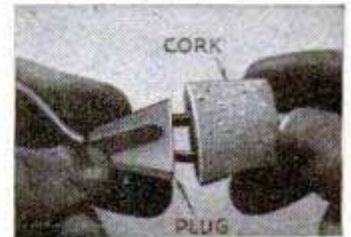
Splicing Tool from Paper Clip

Handy for splicing small, lightweight rope, this tool consists of a wire paper clip and a dowel. The upper drawing shows how the clip is bent and the ends inserted into a dowel handle. The lower drawing illustrates the manner in which the splicer is used. Reference to any manual on the subject will show how splices are made.



Prongs of Electric Plug Shielded With a Large Cork

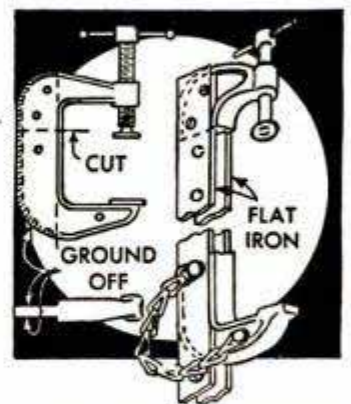
If the prongs of the plugs on electric appliances in your home are sometimes dropped on the floor and damaged or stepped on and bent, get a few corks and use them as shields on the prongs when the plugs are pulled from the receptacles. Slits for the prongs are made with a knife.



Kenneth Murray, Colon, Mich.

Making Extension Clamp

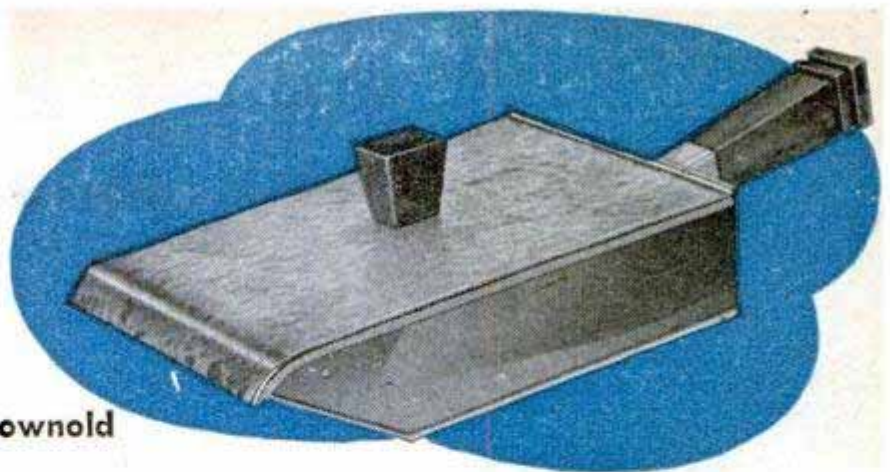
An excellent bar or extension clamp of practically any length can be made with very little expense from a C-clamp. Saw the clamp into two parts at the point indicated and then grind off the rib portion on each part as shown. Using two flat-iron pieces for rails, bolt the screw half of the clamp to one end. The other half is made adjustable by drilling a hole through it to take a pin. This pin, which is chained to the clamp for safekeeping, engages holes, spaced 2 in. apart, in the rails.



A. G. Mather, Ottawa, Ont., Can.

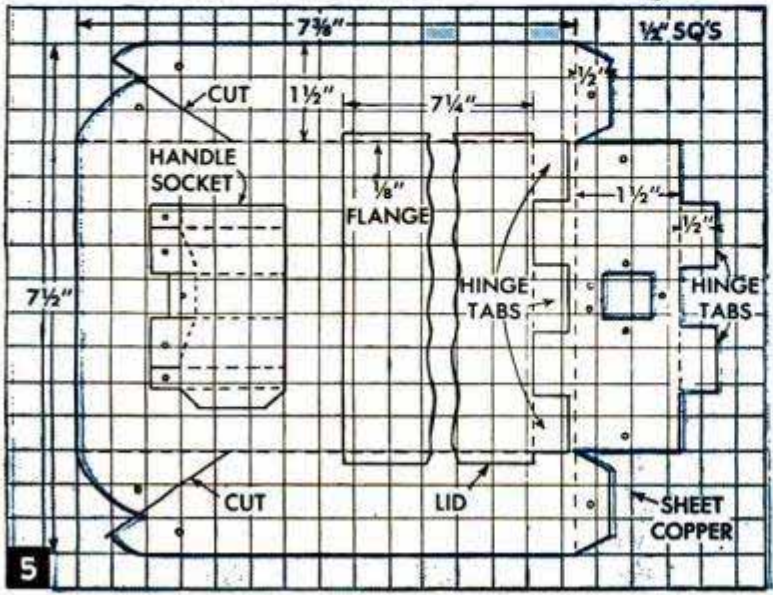
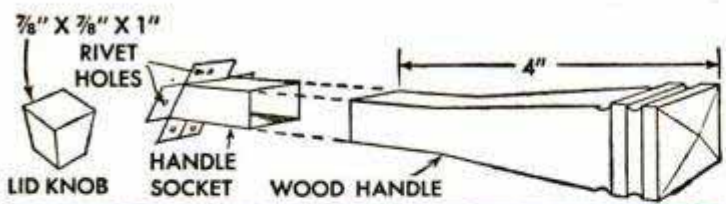
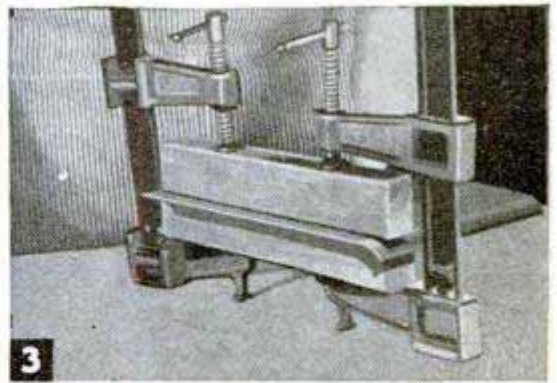
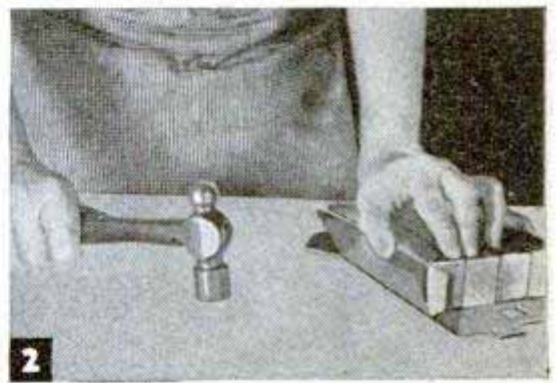
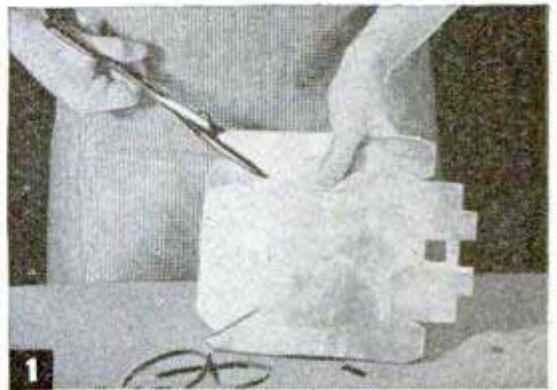
SILENT BUTLER

takes the "brush-off"

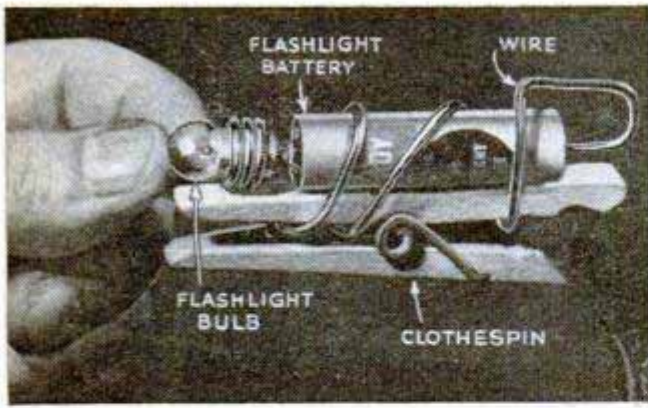


By Charles and Bertram Brownold

REQUIRING only three pieces of 18-ga. sheet copper and two blocks of wood, this attractive crumb tray is simple enough to complete in a couple of evenings. First, draw a full-size cardboard pattern of each of the metal parts, following the squared drawing in Fig. 5. Then trace the patterns on the metal with a sharp-pointed tool and cut out with tinner's shears as in Fig. 1. Next, cut a wooden block slightly smaller than the inside of the tray and use it as a bending form. After bending the sides of the tray against the block, Fig. 2, fasten each corner together with a small rivet. The lid of the tray is shaped by clamping it between two blocks as shown in Fig. 3. A $\frac{1}{8}$ -in. flange is formed along two sides of the lid by letting the metal project between the blocks and then bending the edge downward. The top surface of the lid is given a hammered finish with the round end of a ball-peen hammer, Fig. 4, after which the hinge tabs are formed around a stiff wire and the knob and handle attached. Brighten the metal by polishing with steel wool and apply clear lacquer to prevent tarnishing.

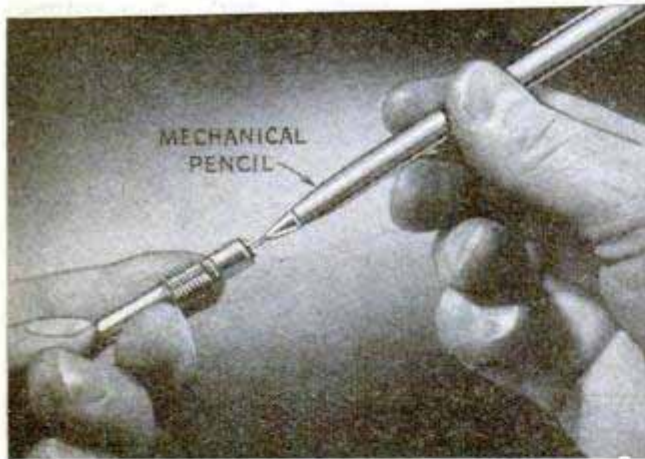


Novel Clothespin Flashlight Frees Hands for Work



Light where you want it—that's the feature of this clothespin flashlight. You can clamp it to anything convenient, which makes it ideal for work where both hands are needed. Just four items are all you need to make it: A penlight dry cell and bulb, a length of heavy copper wire and a spring-type clothespin. Coil one end of the copper wire around the grooves in the base of the bulb to form a socket, then continue to wrap the wire around the dry cell and clothespin as shown. Finally, bend the end of the wire to bear against the bottom of the dry cell. Screwing the bulb in or out serves as a switch.

Pencil Substitutes as Depth Gauge



Depth of small holes can be measured quickly and with a fair degree of accuracy by using an ordinary mechanical pencil. Rest the tip of the pencil on the edge of the hole and screw out the lead until it touches the bottom. The distance from the end of the lead to the tip of the pencil is the depth of the hole.

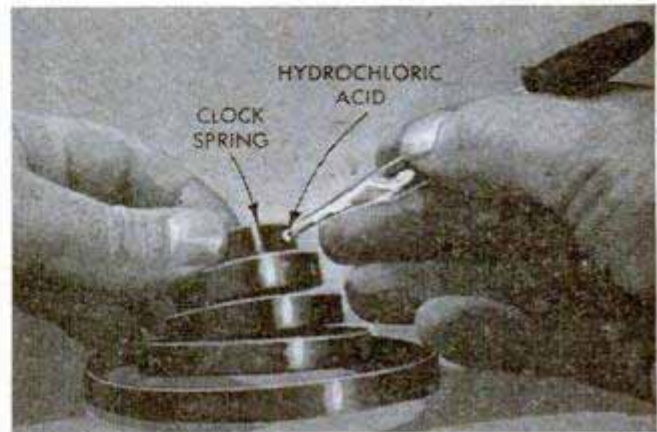
"Weatherman" Indicates Humidity

If you like photo novelties, you will enjoy a "weatherman" or humidity guide. It is a chemically coated print that changes color when it absorbs or releases moisture.

The coating solution is made as follows: warm water, 4 oz.; cooking gelatin, 100 grains; cobalt chloride, 50 grains; and glycerine (water free), 10 drops. Dissolve the gelatin in the warm water, using a double boiler so that direct heat is not applied. Then dissolve the cobalt chloride and add the glycerine. Apply the warm solution by dipping the print or by covering lighter areas with a brush. Changes in moisture are indicated by the coated parts. They change from pink (in damp weather) to blue (when the air is dry).

Acid "Burns" Hole in Clock Spring

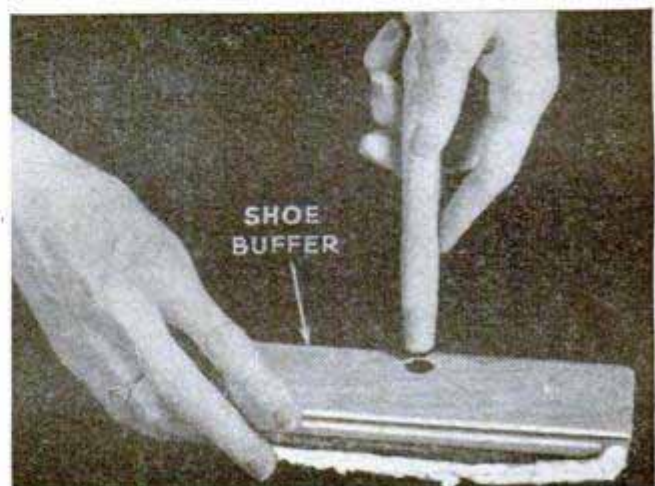
Instead of tedious drilling, holes can be "burned" in a clock spring by using hydrochloric acid. The best way to apply it



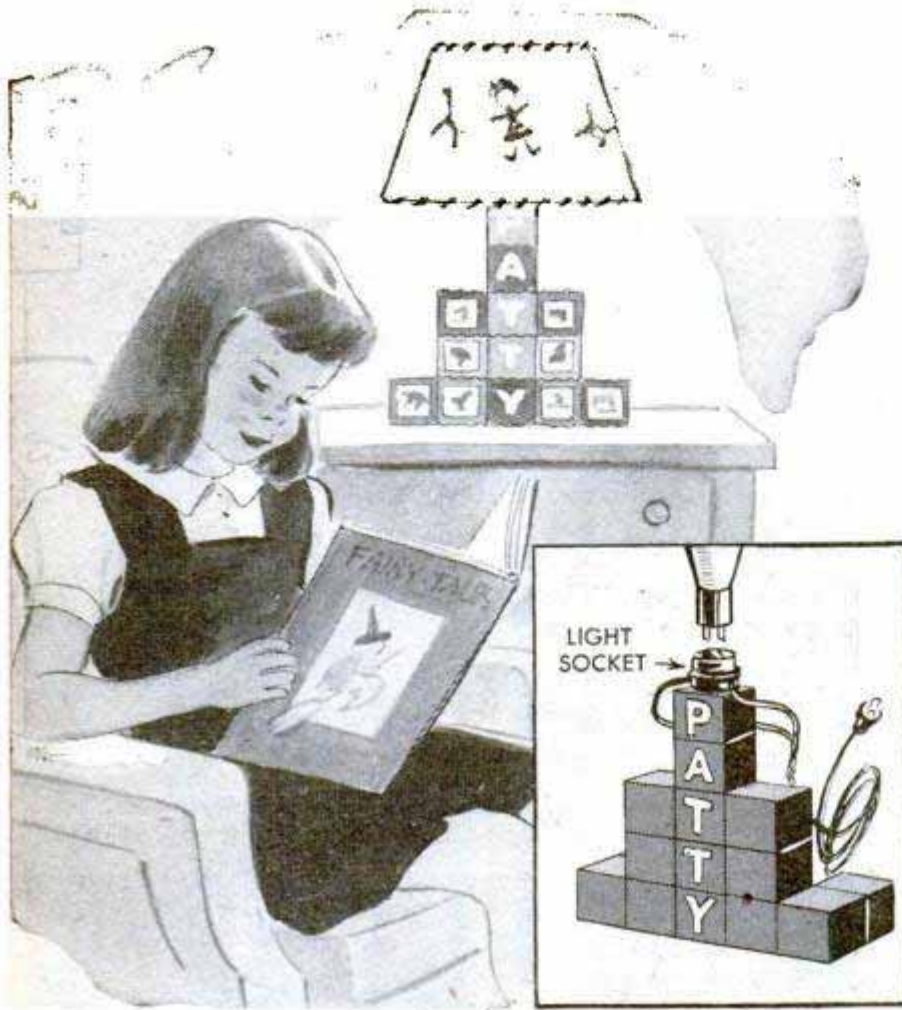
is with the tip of a medicine dropper as this will keep the acid from spreading over too great an area. Or, if desired, the spring can be coated with wax and a small portion scraped away where the hole is to be made. The wax acts as a dam into which the acid is poured.

Shoe Buffer Used to Apply Wax

A shoe buffer will make an efficient substitute for a lost or worn-out liquid-wax applicator. To adapt the buffer to an applicator, merely bore a hole at an angle in the top to take a handle.



Personalized Lamp for Child's Playroom Made From Discarded Alphabet Blocks



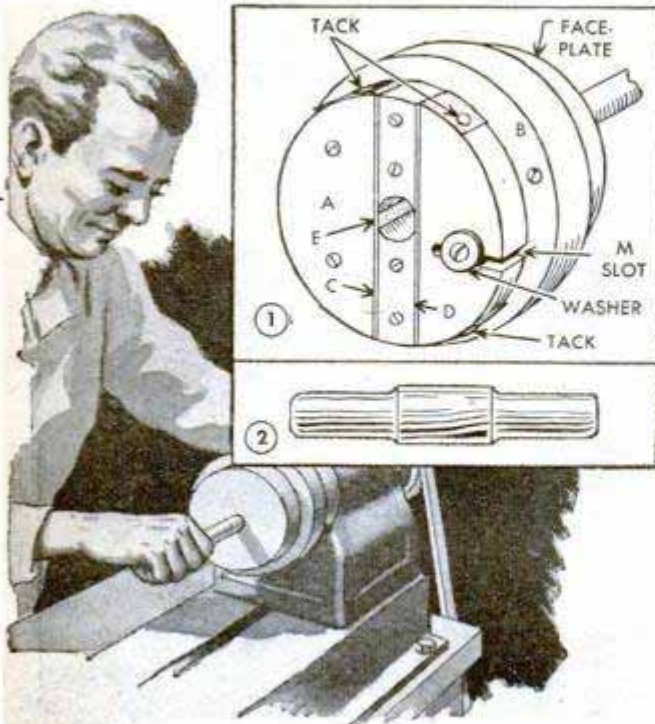
When your small child reaches the age where he or she is ready to discard a set of alphabet blocks for the toys and amusements of older children, keep the blocks to make this personalized table lamp for the playroom. As shown, the blocks in the center column are arranged to spell the child's name or nickname. Assembly of the lamp is simple. Airplane cement or a similar adhesive is used to glue the blocks together, and the socket is a flush-mounted fitting that screws to the top block. Although a two-prong socket and base are shown, a screw-type fitting may be used instead. Either type of flush-mounted socket eliminates drilling a hole through the center blocks and running a lamp cord out through the base. It will be necessary to do this, however, if a recessed fitting is used.—Edward L. Fisher, Milwaukee, Wis.

Duplicate Parts Are Mass-Produced With This Faceplate Sander-Chuck

Having to mass-produce a large number of handles like the one shown in detail 2, I devised this simple sanding chuck to do the job in a hurry. It consists of two hard-

wood disks, A and B, detail 1. Both have a hole E, through the center and disk A has slots for abrasive paper. The two disks are first screwed together, then fastened to a lathe faceplate for truing and boring the hole. Next, without removing the disks from the faceplate, saw cuts C and D are made across the face of disk A and tangent to hole E. Note that these cuts enter just inside the periphery of the hole. Use a narrow-gauge saw blade to make the cuts, especially cut C. The free half of disk A is made adjustable crosswise to take up wear of the abrasive strip, which is held with tacks as shown. In use, round the ends of work slightly to knock off the sharp corners and then simply insert the work in the chuck. With the chuck rotating and the work held stationary, the abrasive strips quickly form the work. The same idea can be applied to any similar job for producing duplicate parts in quantity.

Fred Strickland, Portland, Ore.



☞ To cut marshmallows and keep them from sticking together, use a pair of scissors dipped in lukewarm water frequently.

LAWN HOUSE NUMBERS



Nothing is more appreciated by your callers than a well-designed house number located where it is easy to see. The lawn is the ideal place, so try your hand at some of these. A jigsaw or coping saw and some 1/2 or 3/4-in. outdoor plywood are all you need. Stakes of 1/2-in. pipe will make ideal supports



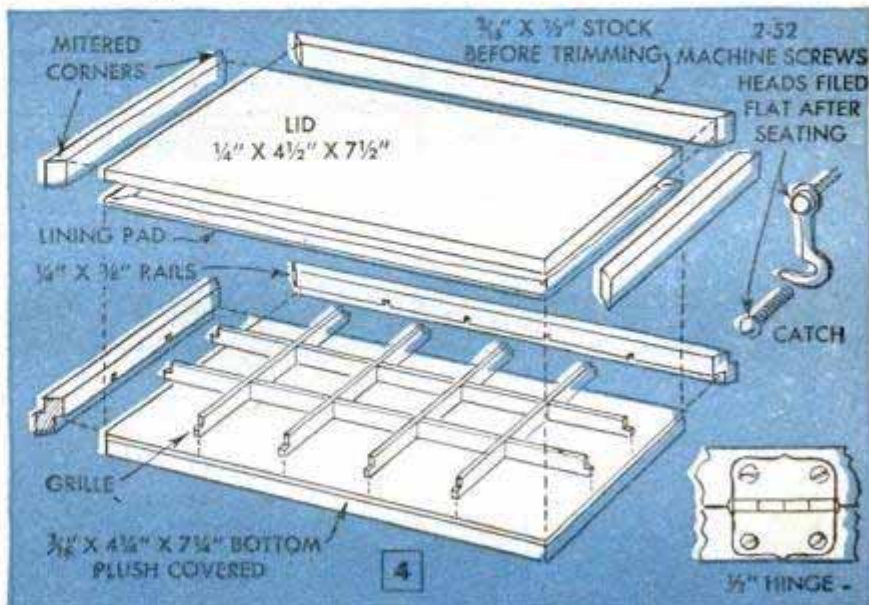
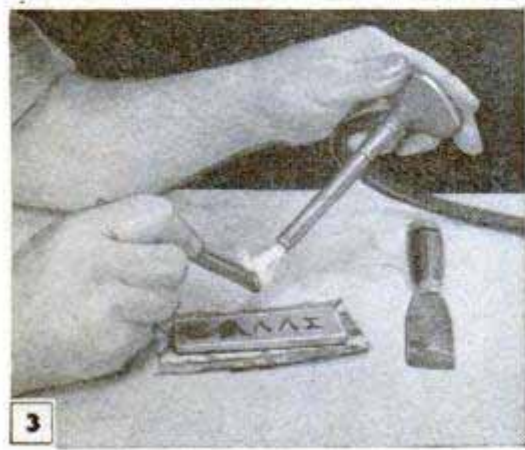
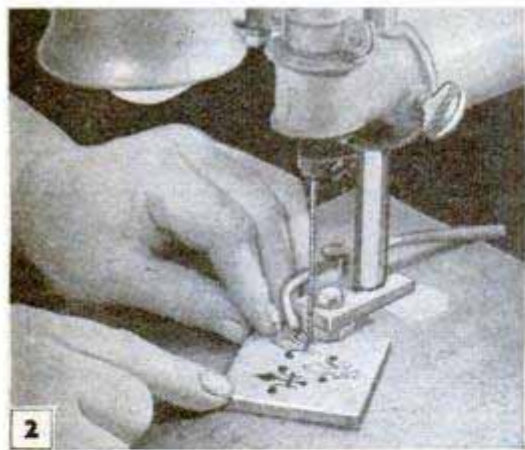
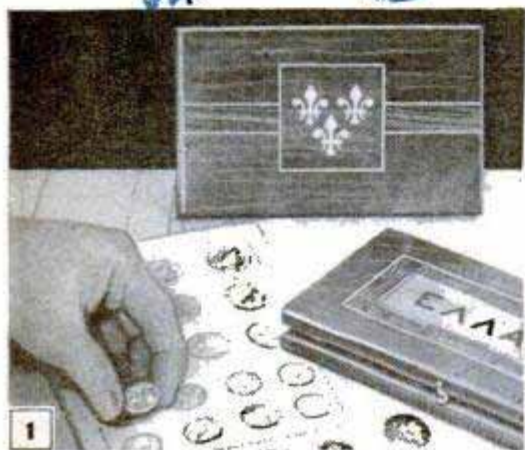
PLUNDER CHESTS for Coin Collectors



By Alexander Maxwell

FOR EXHIBITING and storing valuable collections of rare old coins nothing so satisfies a coin collector as a plunder chest made of fine cabinet woods and inlaid with appropriate symbolic designs in contrasting colors. Carefully finished, the job looks like cabinet work at its finest, but essentially the work is little more difficult than that of building a small box to exact dimensions.

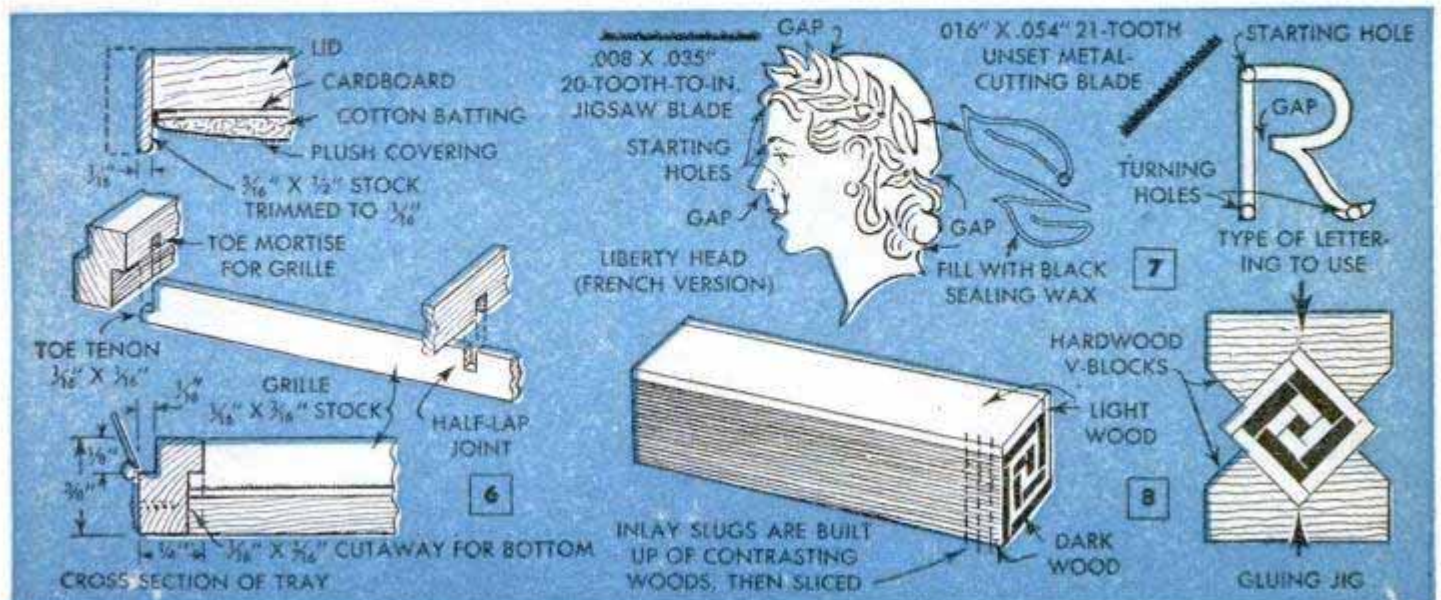
Proportions of the chest are determined by the number of coins to be displayed. For some collections consisting of only a few coins, the pocket-size chest with a hinged lid, Fig. 1, is best. For large collections, the trays of the pocket units are duplicated and fitted into a cabinet as drawers, Figs. 5 and 9. Use vermilion, rosewood or teakwood for all the parts. Fig. 4 details the construction of the pocket unit. Additional details are shown in cross section in Fig. 6. Start with the lid first. The bottom of the tray is cut to size and covered with rich velvet

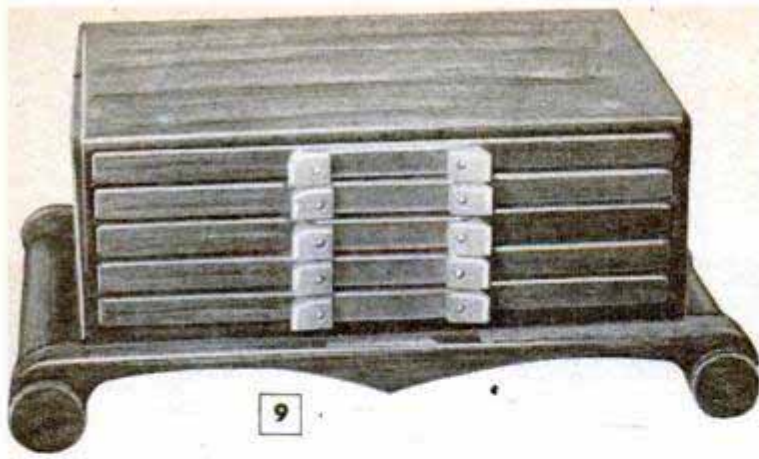




or plush of a dark color, preferably ruby red, purple or dark blue as these colors show the coins to the best advantage. The lid is lined with the same material, fluffed with cotton batting so it presses down on the coins and prevents them from rattling. If coins are of a uniform size a "lattice-work" grille or separator is suitable. It can be mortised into the sides and the whole tray assembled and glued as a unit, or the grille may be merely fitted in place, weighted down and "tacked" with airplane cement. Apply wax to the grille and interior parts and rub down to produce a soft luster. Odd-size coins require considerable planning to produce a suitable display. The built-up grille in the drawer of the center chest, Fig. 5, correctly displays the one large coin.

An effective and simple method of inlaying is done by simply jigsawing the design, Fig. 2, and filling it with melted sealing wax of the desired color, Fig. 3. If all the coins in the chest are from a single country, the inlaid motif may be taken from the symbol associated with that country. Again, the name may be spelled out, as in Fig. 1. Letter piercing such as this requires a stiff jigsaw blade, Fig. 7, which will hold to the line. Another novel form of inlaying is done by jigsawing the line only and filling the saw kerf with a black or contrasting colored wax. This calls for careful work as any irregularity in the kerf shows up badly. The trick in sawing such inlay is never to completely remove a segment. Stop short of the previous cut at each pass. As an example of this, the





cabinet as for the trays or drawers. Rosewood, properly finished, makes a beautiful job. In the detail, Fig. 10, 1 by 6-in. dowels are indicated for the feet but you can easily turn these parts from genuine rosewood at small extra cost for material. Notice that the end pieces are rabbeted to take the top. This is a design characteristic and should not be omitted in authentic construction. Run grooves for the drawer sils, or runners, with a dado cutter or by making two or more passes over the circular-saw blade. Glue

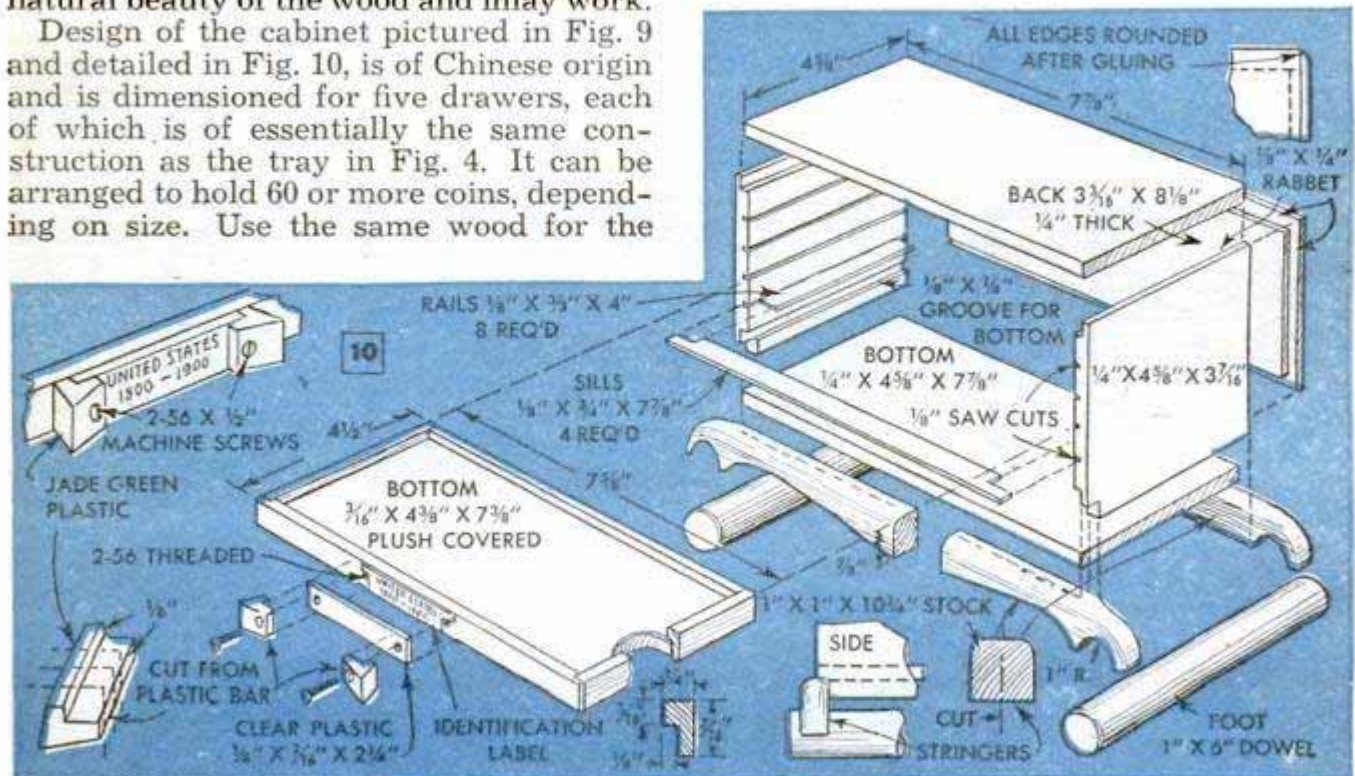
Liberty head is shown, Fig. 7. Starting holes are bored in places which are normally accented and the blade is advanced and backed until cuts from the starting holes are completed. Then the cuts are filled with wax. Wooden inlay slugs can be made up in any pattern for inlaying in a recess. An example of this type of inlay is shown in Fig. 8. The pattern is continuous and is formed by gluing up a square composed of a number of strips of contrasting woods with the end grain showing in a simple geometric pattern. To get the two-color pattern shown, use white holly and black ebony.

When the lid is completed, sand it down to a smooth surface. As the natural tendency is to round the edges when sanding, make the ends, back and front slightly oversize. Then, after sanding, trim the whole box to finish dimensions. Finish with three thin coats of clear lacquer and rub down with rottenstone. On fine woods this treatment gives a surface which is pleasing to the touch, and brings out the natural beauty of the wood and inlay work.

Design of the cabinet pictured in Fig. 9 and detailed in Fig. 10, is of Chinese origin and is dimensioned for five drawers, each of which is of essentially the same construction as the tray in Fig. 4. It can be arranged to hold 60 or more coins, depending on size. Use the same wood for the

the runners in place. Rosewood, due to its very hard surface, does not glue well with ordinary adhesives. Airplane cement is best. When gluing up the parts, be sure to wipe off any excess cement that squeezes out of the joints. When the assembly is completed, place it on a flat surface and test for wobble. If there is any irregularity, sand one end of one of the feet slightly to correct it.

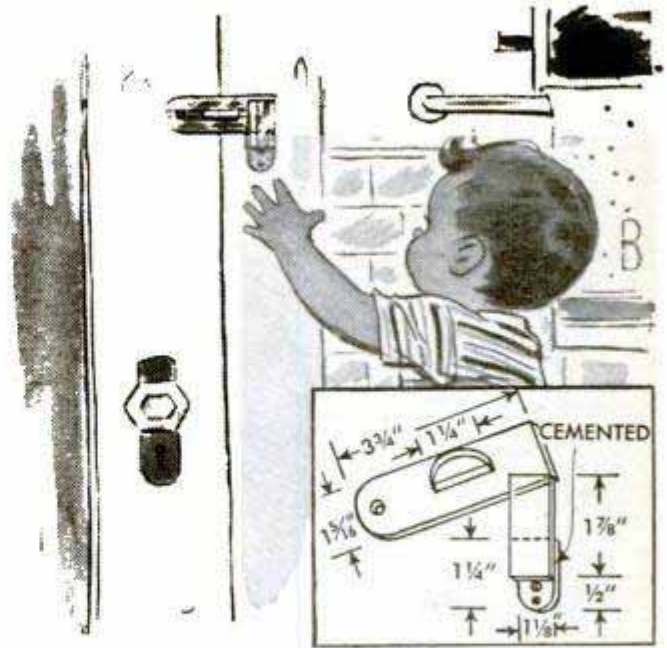
To be authentic in all details, the cabinet should be lacquered Chinese red with stenciled green, black and gold dragons. However, if you use genuine rosewood a natural-color finish is recommended. Use clear lacquer and polish as already described. The usual jade and silver drawer pulls are modernized by using clear plastic tipped with grips of translucent jade green. Slip a label behind the clear plastic, designating the contents of each drawer. The drawers may be partitioned by grilles as in Fig. 4, if desired. The grille is merely weighted in place and "tacked" with airplane or a similar type of cement.



Door Latch Is Easily Forced To Rescue Child Locked In Bathroom

After my small child accidentally locked himself in the bathroom and I had to break a panel in the door to unlock it, I was determined that it would not happen again. First, I removed the turn bolt on the rear side of the lock. Then, from scraps of plastic, I assembled the simple latch shown, cementing the parts together where indicated, and screwed it to the door beyond the reach of the child. The latch was strong enough to keep the door locked, but being cemented together, it could be broken apart by pushing the door inward in the event the child should close the latch by climbing. To assure a good bond in cementing the parts together, roughen the contacting surfaces. This can be done by rubbing them with coarse sandpaper, after which cement is applied to both surfaces.

Herman R. Wallin, Washington, D. C.



Snap-Action Switch on Soldering-Iron Stand Regulates Heat Automatically

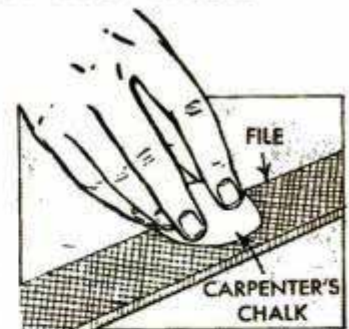
Here is a stand that is just the thing for an electric soldering iron that is used intermittently. The regular stand is fitted with a snap-action switch, which cuts in the resistance of a lamp bulb to operate the iron at reduced temperature when it is placed on the stand. This prevents burning and the rapid oxidation of the tip which results from overheating. The wiring diagram shows the electrical hookup. Legs at one end of the stand are removed. Then the switch is fitted underneath with the striker or actuating arm projecting through the bottom of the stand in such a position that

when the iron is laid on the stand its weight will close the switch and cut in the lamp bulb, which is wired in series. The size of the lamp bulb should vary according to the size of the iron. Some experimenting will be necessary to determine the size of lamp bulb to use.



File Can Be Made Nonclogging By Rubbing Teeth With Chalk

Before starting to file nonferrous metals, such as brass, copper or aluminum, take this tip from a machinist: rub the teeth of the file with a cake of carpenter's chalk and they will not clog with filings. Then all you have to do to clean it is to tap the file against the bench occasionally. The chalk coating is renewed from time to time.

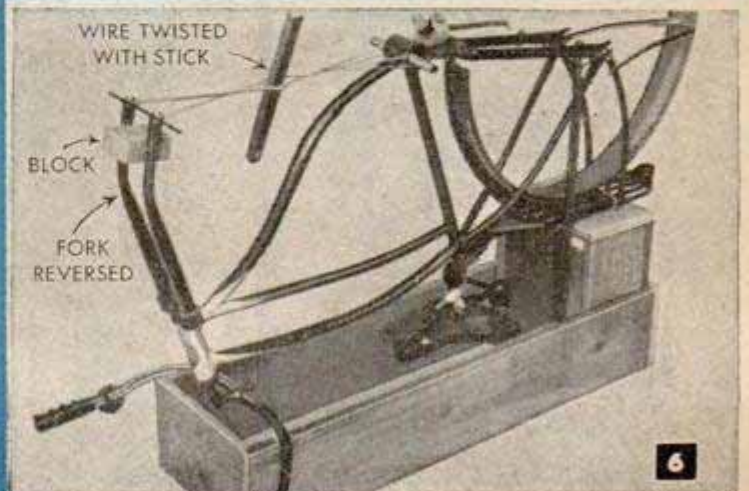
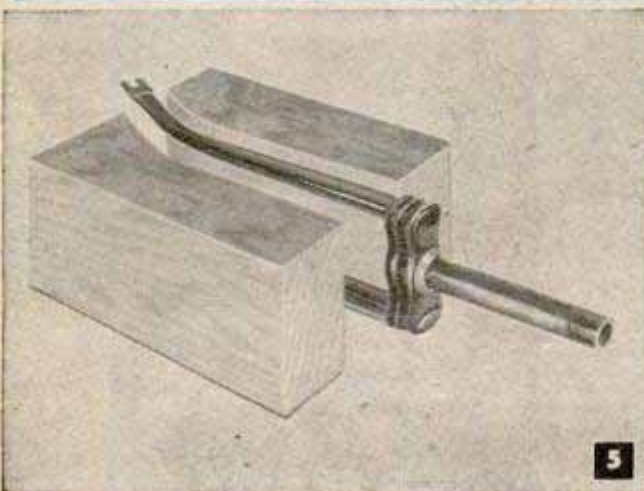
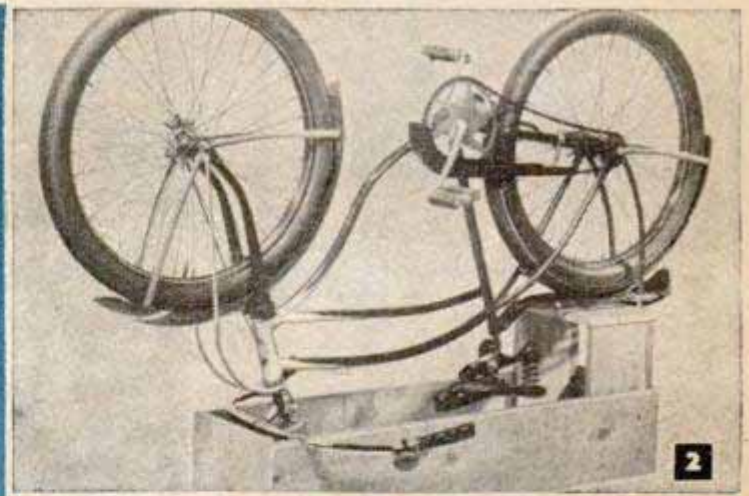
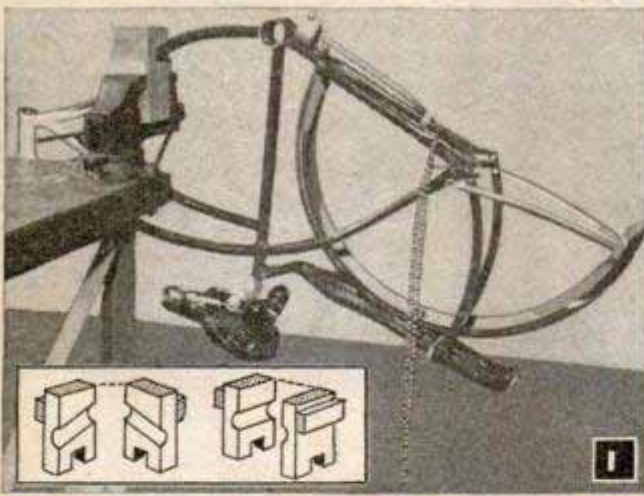
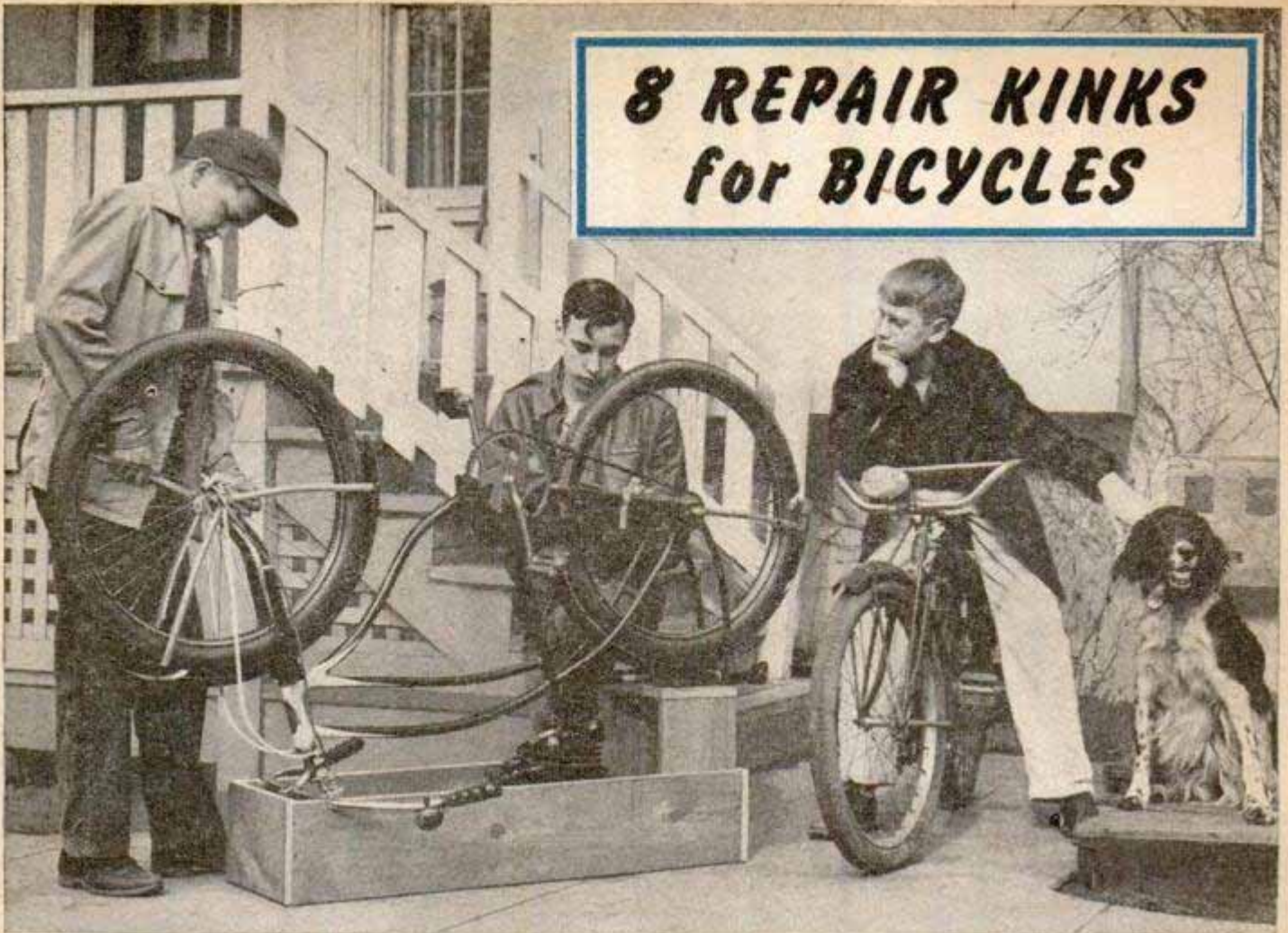


Match-Book Guard for Razor Blades

Double-edged razor blades are convenient for ripping seams, cutting thread and, in general, a handy tool to have in the sewing basket. However, careless handling will result in cut fingers. To prevent this, cut off one end of a paper match book, the end that has the striking surface, and slip it over one edge of the blade to act as a guard. The abrasive surface of the match-book end will afford a firm grip.

William Swallow, New York City.

8 REPAIR KINKS for BICYCLES



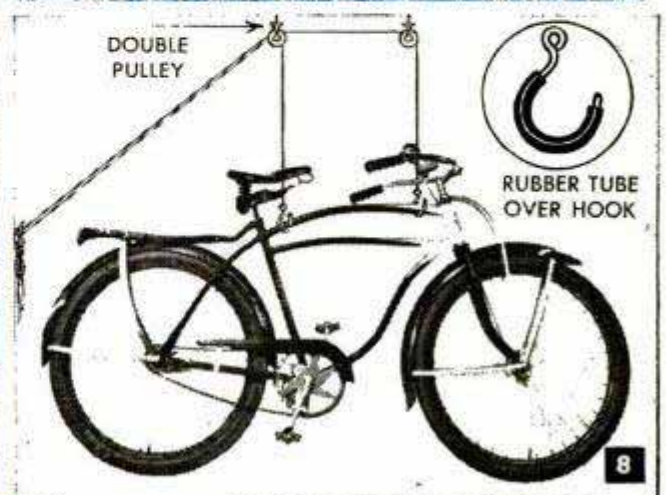
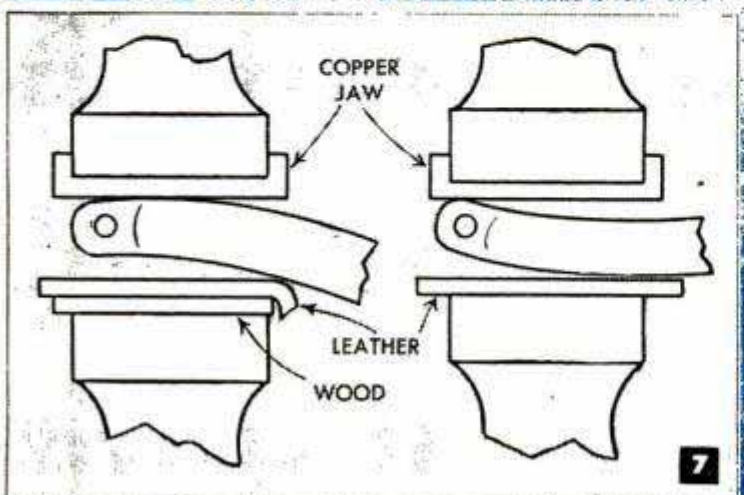
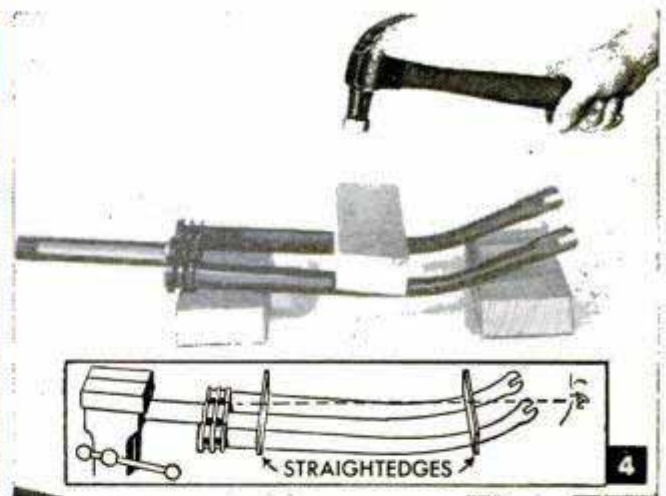
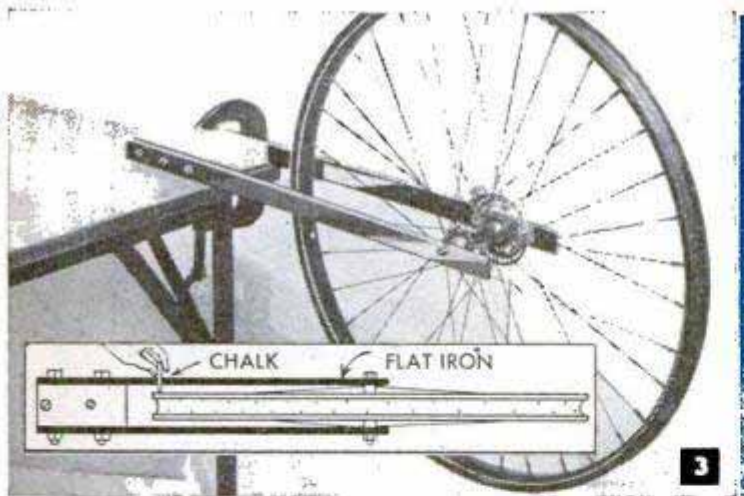
Why not make your own bicycle repairs and thus avoid the long delay of waiting for your turn at busy repair shops?

MOST bike repairs are quite easy to make if one takes the time to build a few simple jigs and clamping devices with which the work can be done in a professional manner. Ordinarily the frame of a bike is difficult to hold securely by any ordinary means, but with special pine clamping blocks detailed in Fig. 1, the frame of a dismantled bike can be supported rigidly in a bench vise in almost any position desired without damaging the finish or springing any part of the frame. A frame or fixture to hold the complete bicycle and into which it can be placed upside down in a jiffy is shown in Fig. 2. This is handy for repairing the chain and bearings, and also for removing the wheels. With the bicycle held in this fixture, every part of it can be disassembled except the fork.

For truing wheels, fasten flat-iron bars to a workbench or a rigid table as in Fig. 3. Notches in the ends of the bars receive the axle. These should be a snug fit, as any play here will interfere with proper adjustment. While rotating the wheel slowly with one hand bring a piece of chalk up to the rim and withdraw as soon as it touches. This will indicate where the rim

is out of true. The spoke on that side should be loosened, and the adjacent spoke tightened. Of course, this may also require adjustment of several adjoining spokes, and to compensate and tension the wheel properly it generally is necessary to slacken or tighten several spokes on the rim at a point opposite the first adjustment. All spokes should have as nearly equal tension as possible. To true up a fork which has been distorted or bent by a blow or collision requires great care because the two legs must be absolutely parallel when the work is finished. If one leg of the fork is bent sideways, clamp the shank between clamping blocks, Fig. 1, in the vise and spring the bent member back into place. If bent forward or back, place the fork on two hardwood blocks on the floor, and strike light blows on a third block placed on top as in Fig. 4. Accuracy can be checked with two straightedges.

Where the legs have an equal bend near the shank, use the method pictured in Fig. 6. Curved hardwood blocks are useful in bending forks in the vise, as in Fig. 5. Both forward and backward bends in the fork are also accomplished in the vise as indicated in Fig. 7, using a copper jaw on one side and leather on the other. Fig. 8 suggests a quick method of swinging the bicycle up out of the way in the garage.



Holder Suspends Paintbrushes In Cleaning Solution



When paintbrushes are set in a can of cleaner to keep them from hardening between jobs, the bristles may become bent out of shape. A simple holder to keep the bristles off the bottom of the can may be bent from a piece of heavy wire. The can sets on the lower end of the holder.

Grip of Paper Clips Improved By Rubber Coating

If you have experienced trouble in having paper clips slip, especially when used on a stack of papers that is a little too thick, try coating them with a film of rubber. To do this, merely dip them in rubber cement, white rubber tire coating or even tire-patching cement. This will leave a film of rubber on the clip, which when dry, provides a non-slip surface on the clip.



Spring Restores Oilcan Action



An oilcan of the type pictured may wear so that the bottom will not snap back into place when pressed to force out the oil. However, you can restore the snap action with a spring. Cut off a piece of old screen-door spring and stretch

it to produce a compression spring. Insert one end into the lower end of the spout. Then, when the spout is screwed onto the can, the lower end of the spring will press on the bottom of the can. Length of the spring will depend on the depth of the can

and the distance the spring slips into the end of the spout. If the spout is too small to take a screen-door spring, any compression spring, or a tension spring that has been stretched, that will just enter the lower end of the spout will do.

Miniature Spur Center Is Handy For Turning Small Work



This tiny spur center, which can be held in a drill chuck in the wood lathe, is useful for driving small work such as dowel stock, ship-model masts, yardarms, arrow

shafts and other turnings too small to be driven by the regular spur center. To make it, first drill a $\frac{1}{8}$ -in. hole in one end of a 2-in. length of $\frac{3}{8}$ -in. steel rod. Shape the spurs with a triangular file, cutting two deep notches across the drilled end of the rod. Then grind one end of a short length of $\frac{1}{8}$ -in. drill rod to a sharp point to make the center pin. Force this into the hole drilled in the end of the spur center with the pointed end projecting about $\frac{1}{16}$ in. beyond the edges of the spurs.

Tire Coating Identifies Toys

There will be less chance for misunderstandings among small children in your home if each of their rubber toys are identified with the owner's name

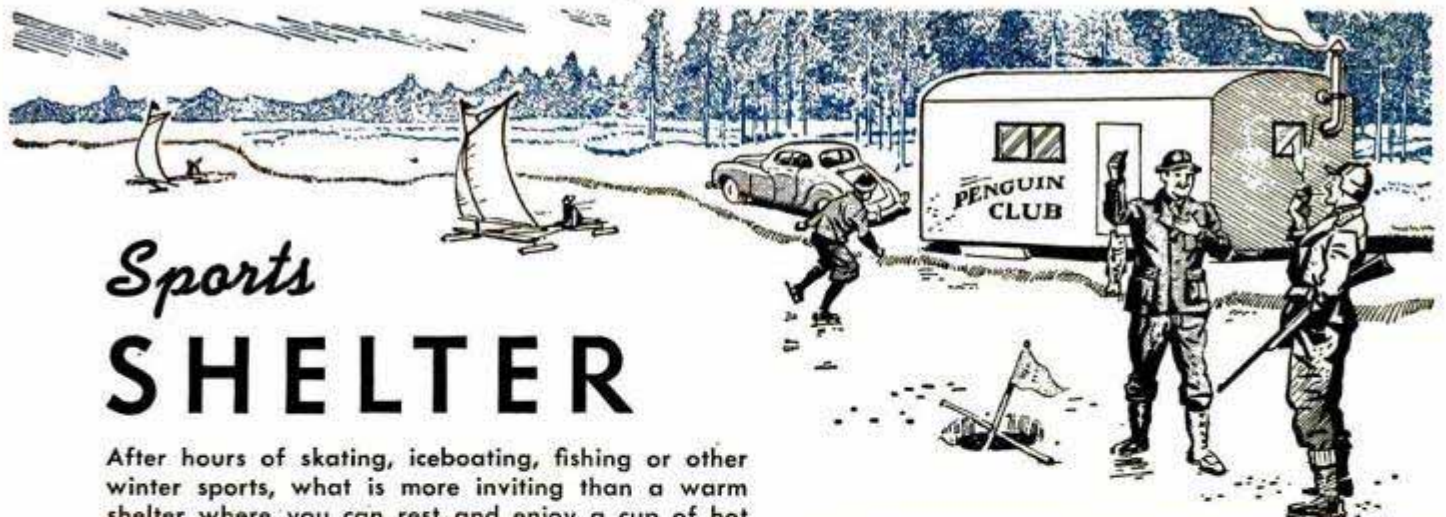


or initials. You will find that white rubber tire coating is ideal for applying lettering to such articles as the rubber ball shown in the photo.

Making Bottles Shatterproof

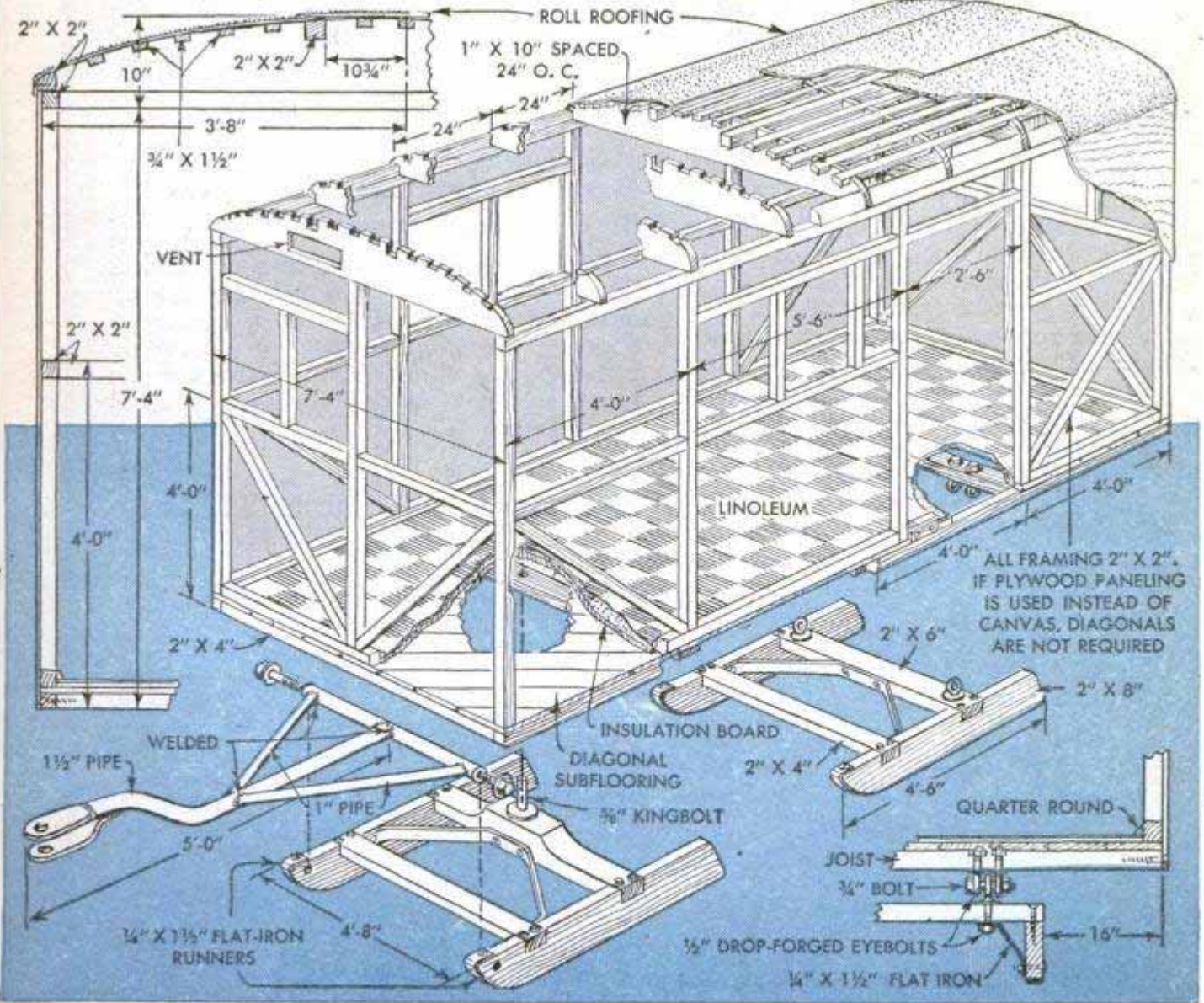
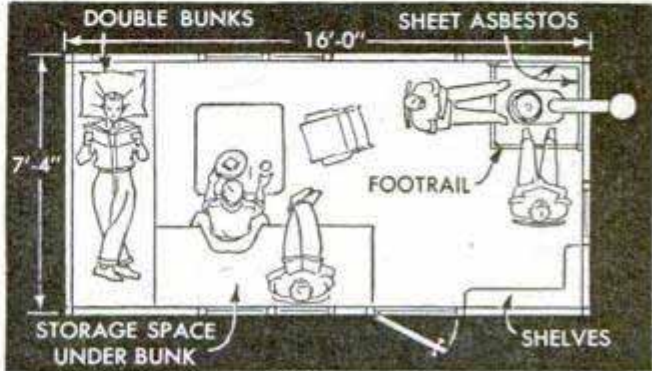


If you have bottles of rare chemicals or other valuable materials, especially those in powder or granular form, it is a good idea to wrap the bottles with cellulose tape as indicated. Then, if they are accidentally dropped and broken, the bottles will not shatter and scatter the contents.

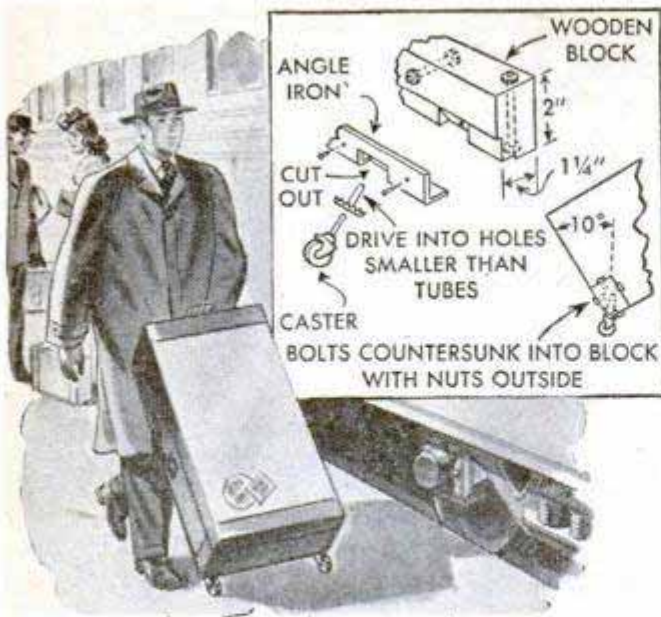


Sports SHELTER

After hours of skating, iceboating, fishing or other winter sports, what is more inviting than a warm shelter where you can rest and enjoy a cup of hot coffee? Such a shelter is not expensive to the individual if several sports fans pool their time and money to build it. This one, which is equipped with runners for towing, can be constructed of used or second-grade lumber. The framework may be covered with plywood, or canvas to reduce the weight for distant towing. The windows are Celluloid and the door is 1/2-in. plywood. Note that the floor should be insulated before covering it with linoleum, and that the roof is ribbed and covered with roll roofing. A small sheet-iron stove will furnish adequate heat, and by installing bunks, as shown, comfortable quarters will be had for an extended fishing trip



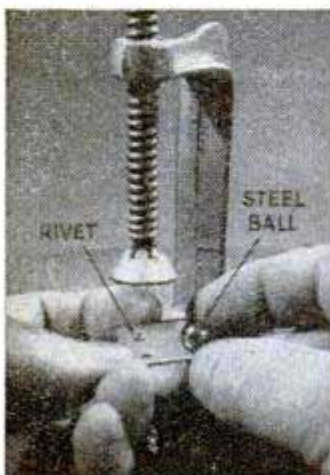
Caster-Fitted Luggage Is Pushed Like a Wheelbarrow



Instead of carrying heavy trunk-type luggage, mount detachable casters on one side and move it wheelbarrow fashion as indicated. The manner of attaching the casters is simple and does not mar the appearance of the luggage, as the only parts exposed are the caster sockets and casters; the bracing being installed on the inside. A hardwood block is used to anchor the caster sockets and this is cut to fit across one end of the luggage. Note in the detail that one edge of the block is rabbeted to receive a length of angle iron which has an opening cut in it near each end to admit a caster socket. The rabbeted edge of the wood behind the opening in the angle iron is beveled to give the caster a 10-deg. rake. Flat-headed screws are used to fasten the angle iron flush with the block and then bolts are used to attach the block in the corner of the trunk. Undersize holes are drilled through the luggage at the corner and into the wooden block for casters.

Clyde Cameron, Chicago.

Hollow Rivets Set With C-Clamp

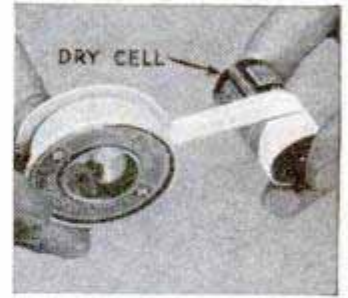


The next time you have a few hollow rivets to set, and there is no set at hand, try a C-clamp and a small steel ball that will just start to enter the open end of the rivet. After placing the rivet in position in the work, put it in the clamp with the open end

of the rivet upward. Place the ball on the rivet and apply pressure to it by turning the clamp screw.

Tape Wrapped Around Dry Cells Protects Flashlight Case

If a flashlight is used infrequently, the dry cells may corrode and swell, making it difficult to remove them from the case. Also, this may result in damage to the switch or case.



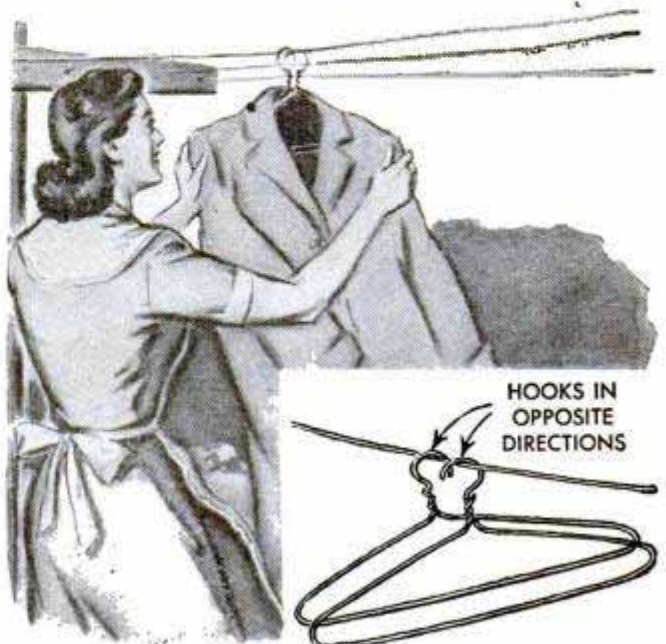
To prevent this, wrap the cells with waterproof adhesive tape, leaving top and bottom uncovered. A layer of tape is sufficient and will not interfere when the batteries are slipped in and out of the case.

How to Clean Furniture Hardware

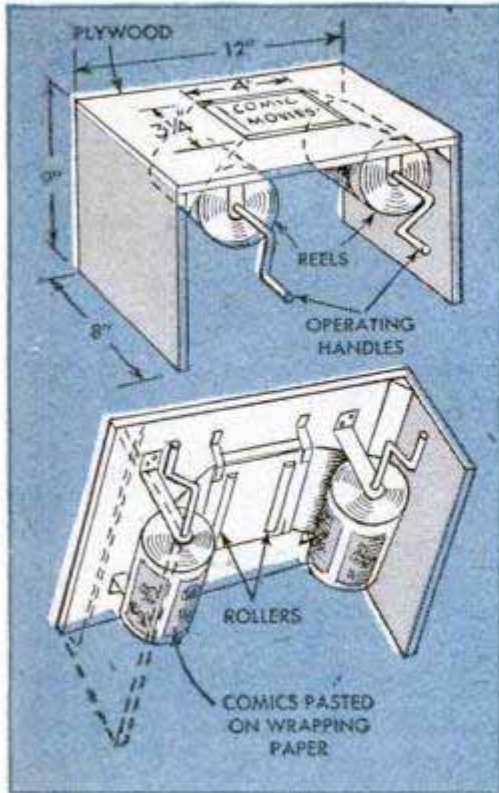
Before cleaning furniture hardware, remove it to prevent marring the surrounding surface of the wood. Then, using an old toothbrush, scrub the metal with a mixture of pumice stone and water until all the dirt is removed. After the metal has dried, polish with dry whiting. To prevent tarnish, coat the hardware with lacquer.

Garments Held On Clothesline By Crossing Hangers

When airing garments on a clothesline, hang each one on two hangers hooked over the line with the hooks pointing in opposite directions as shown in the detail. If buttoned or pinned closed, the garments will not blow off the line even in a strong wind.—Opie Read, Jr., Chicago.



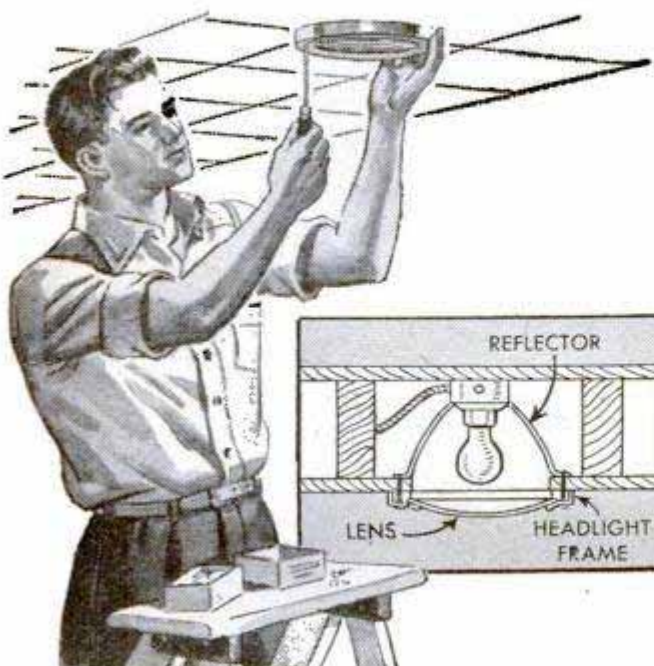
Children's Home "Movie" Shows Comic Strips



THIS easily constructed viewer will enable your children and their friends to get more enjoyment from newspaper comic strips. Make the box from thin plywood and the rollers, which keep the strip level, from $\frac{1}{4}$ -in. dowel. The dowel rollers are pinned in slots cut in a $\frac{3}{16}$ -in. wooden platform which is centered and suspended with metal brackets below the opening in the box. After the parts are made, assemble them as shown in the drawing. Clip the

comic strips from the newspapers for several days and glue them in sequence on a strip of heavy wrapping paper cut to fit wire reels or cranks. Be sure the glue is one that will not soak through the paper. Then wind the wrapping paper on the reels so that when one of the operating handles is turned the frames will appear in the opening of the box. If you wish, make several of these rolls so that the children can interchange them on the cranks.

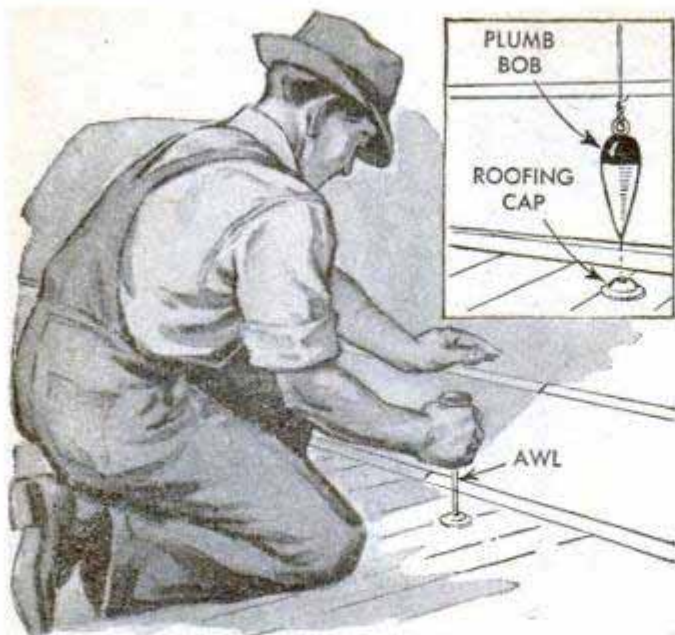
Recessed Ceiling Light for Playroom Made From Auto Headlight



A recessed ceiling light in a playroom or workshop is less likely to become broken than one that is surface mounted. Although such fixtures are fairly expensive, one that will provide excellent illumination can be made from an auto headlight. Cut an opening in the ceiling about the same diameter as the front of the reflector. Then slot the edge of this opening so that the reflector can be slipped through it, first cutting an opening in the small end of the reflector for a porcelain socket. Fasten the socket in place and mount the reflector lens and headlight frame as indicated. To remove bulbs from the light, just unscrew the frame holding the lens.

☞ To remove iodine and Mercurochrome stains from the hands, satisfactory results can be obtained by using ordinary rubbing alcohol as a cleansing agent.

Roofing-Nail Cap "Spots" Position Of Plumb Bob



To eliminate the use of pencil marks, which often are difficult to find after they have been made, one plumber uses a roofing-nail cap and an awl to spot points located by a plumb bob. The hole in the cap is placed directly below the point of the bob and the mark is made with an awl. This method is accurate and it is easy to find the mark thus made because it can't be rubbed out accidentally.

G. E. Hendrickson, Argyle, Wis.

Marks on Wheel Indicate Balance

One way to help keep the front wheels of an auto in balance is to spot marks of bright paint on the edge of the rim and the tire, one directly above the other. Then, when a repaired tire is replaced on the rim, the marks are lined up.

Plates Keep Grease off Burners

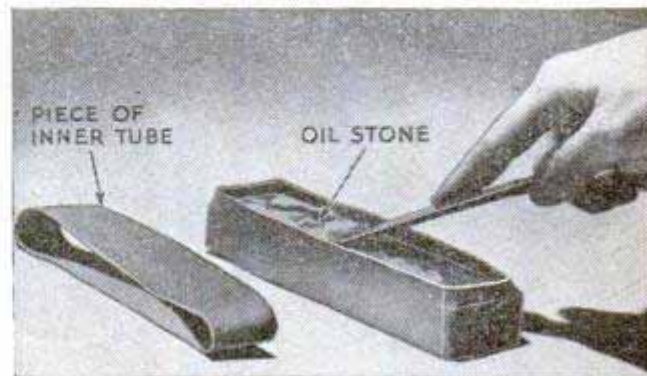
When frying meat or any food that tends to spatter grease, place paper plates over the stove burners that are not being used.



This will protect them from grease spots and save much cleaning time. Remember, however, that the plates, being of paper, can catch fire easily, so be careful how they are handled.

Inner-Tube Band Around Oil Stone Retains Lubricant

Cut a wide band from an auto inner tube and fit it around the sides of an oil stone so that it projects above the surface. This will form a retaining wall to hold oil on top of



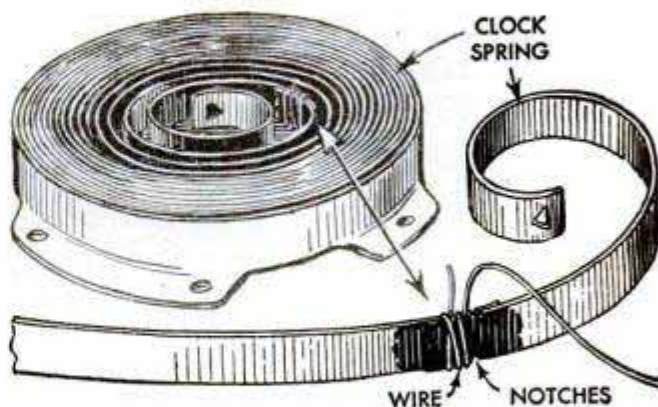
the stone when in use. In addition, the rubber protects the stone from being chipped or marred when clamped in a vise.

J. A. Richards, Saco, Maine.

Repairing Broken Clock Spring

If the mainspring in an inexpensive or worn alarm clock is broken, and the cost of a new one does not seem justified, here is one way to fix the spring and get additional service out of the timepiece. Remove the spring and overlap the ends about $\frac{3}{4}$ in.; clamp in a vise and file a series of small notches in both edges. Then wrap the overlapping parts with fine wire, winding it in the notches to prevent slipping.

Bruno Racine, St. Jacques, P. Q., Can.



If a partition is soldered in a cleaning pail to divide it in half, both soapy water and clean water can be carried in the same container. This will reduce the amount of work necessary in washing windows and woodwork.

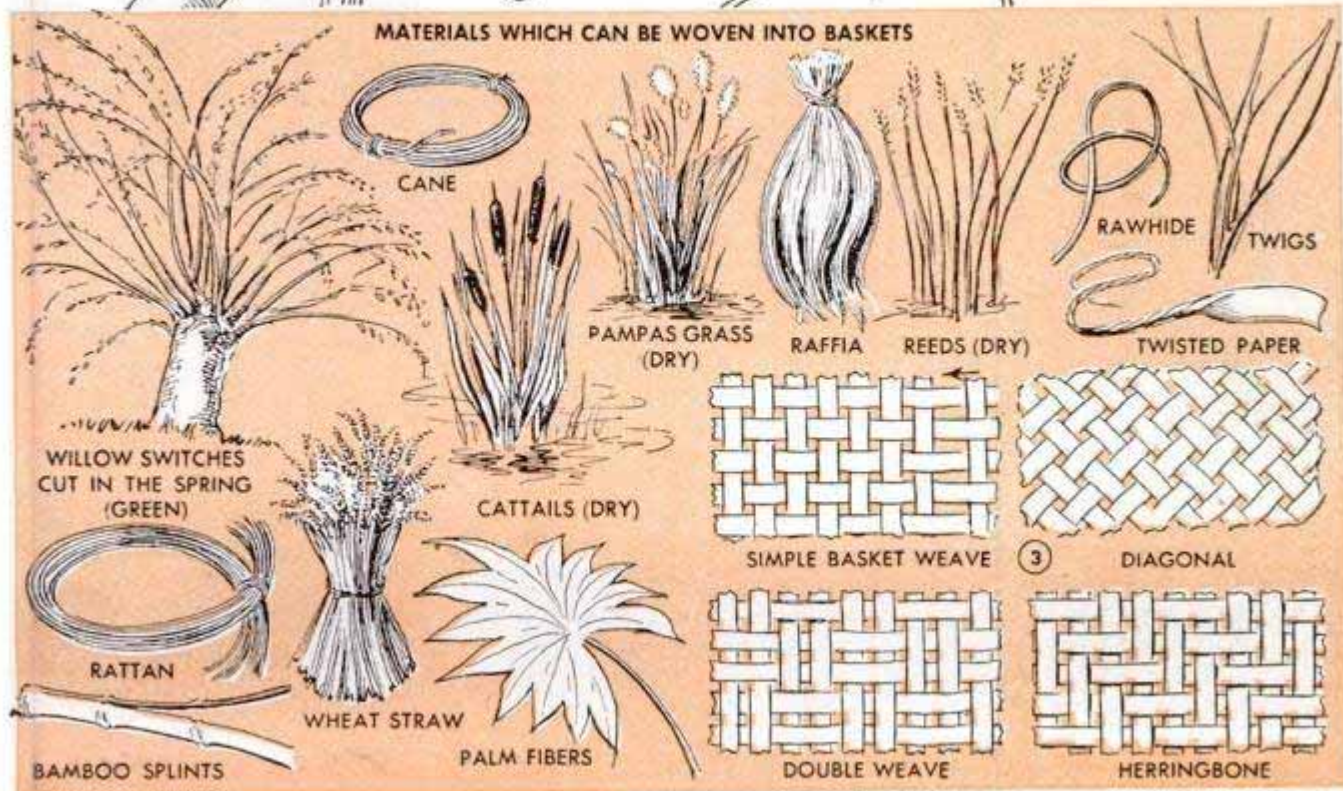
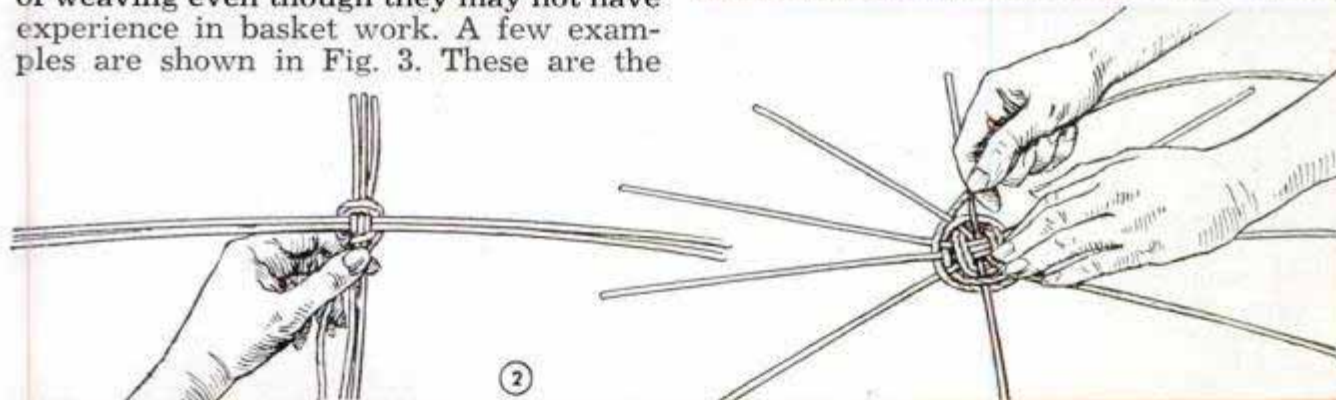
USEFUL BASKETS

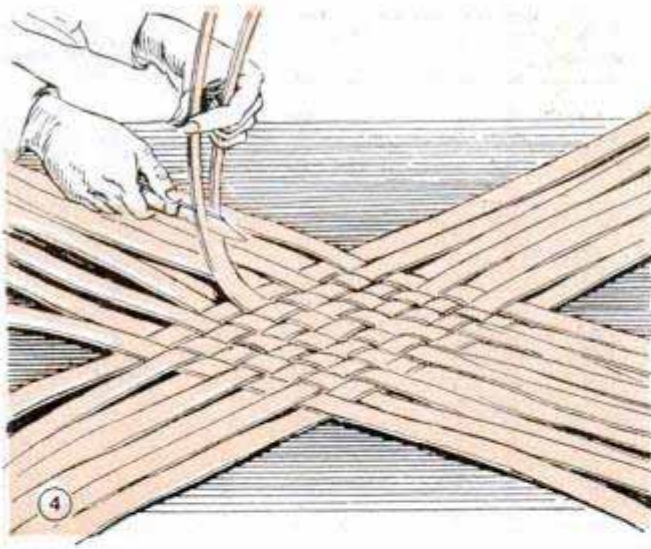
woven from rustic materials

By *Hi Sibley*

ALTHOUGH it is one of the oldest of the handicrafts, basket weaving is still a popular and profitable hobby. Few crafts utilize so many different and inexpensive materials which are readily available almost anywhere. Only a few common hand tools are required: a small handsaw, hammer, drawshave, pliers and pocket knife take care of ordinary requirements.

Among the materials used are green willow twigs or switches, rattan, bamboo splints, wheat straw, dried cattails used flat or twisted, raffia, palm-leaf fibers, thin wood splints such as hickory and basswood, rawhide thongs, cane, twigs, dried reed and pampas grass, tough, twisted paper, and even twine. Most of these are illustrated in the details below. Nearly everyone is familiar with the basic principles of weaving even though they may not have experience in basket work. A few examples are shown in Fig. 3. These are the



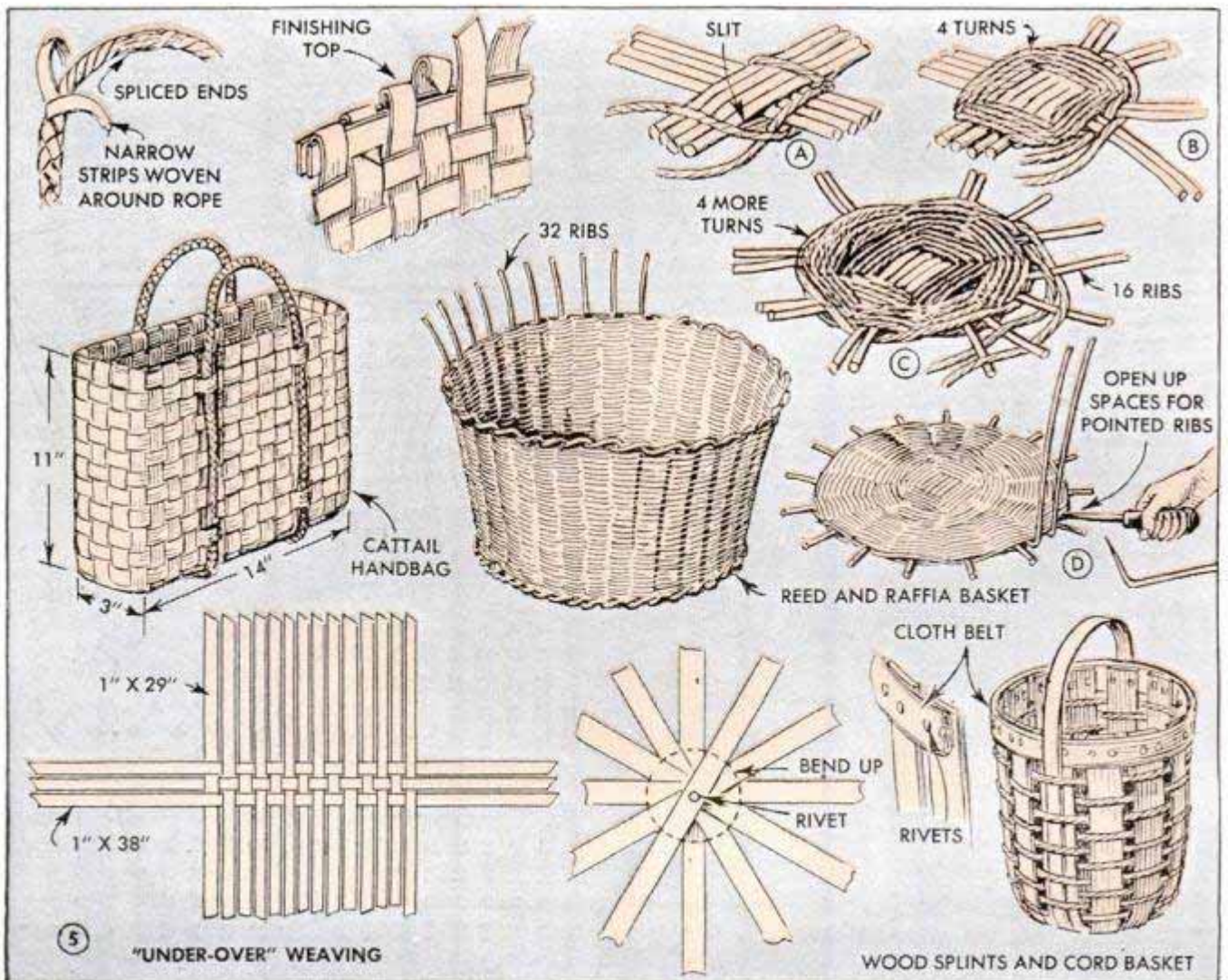


basket weaves done with flat strips, also willow, rattan, rawhide and similar materials adapted to tighter weaving. Several useful baskets of comparatively simple construction are illustrated in Fig. 5, along with the methods of weaving the different types. Most of this work classes as "under-over" weaving.

As a typical example, an attractive and very handy shopping bag made of dried cattails or rushes is detailed in Fig. 5. It is finished with a cotton-rope handle bound

around with narrow strips of cattail stems. Gather the longest cattail stems you can find and with a razor blade guided along a straightedge, cut them in 1-in. strips after they have been thoroughly dried in a shady spot exposed to a breeze. Some of the strips are stained lightly with a brown stain, others left in a natural color to give a two-tone pattern in the finished work. When the cattail strips are thoroughly dry, weave three 38-in. strips into fourteen 29-in. strips in a simple under-over weave as in the lower left-hand detail in Fig. 5. Then bend up the strips to form sides and weave in horizontal strips until the required height is reached. Some weavers split the vertical strips, Fig. 4, and tighten the weave so that the top is smaller than the body of the basket. Before finishing the top edge, note that there are two horizontal strips instead of one. Ends of the vertical strips are turned over and tucked in. A cloth lining, with pockets for purse, letters, etc., will add to the convenience of the bag. The dry cattails will support any load that can be carried easily.

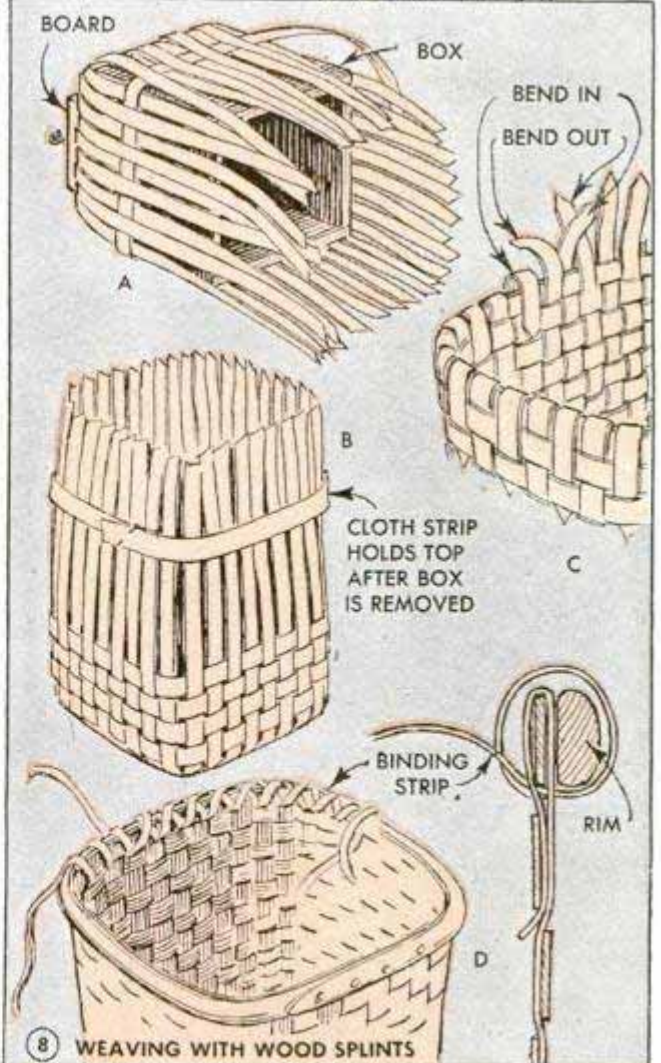
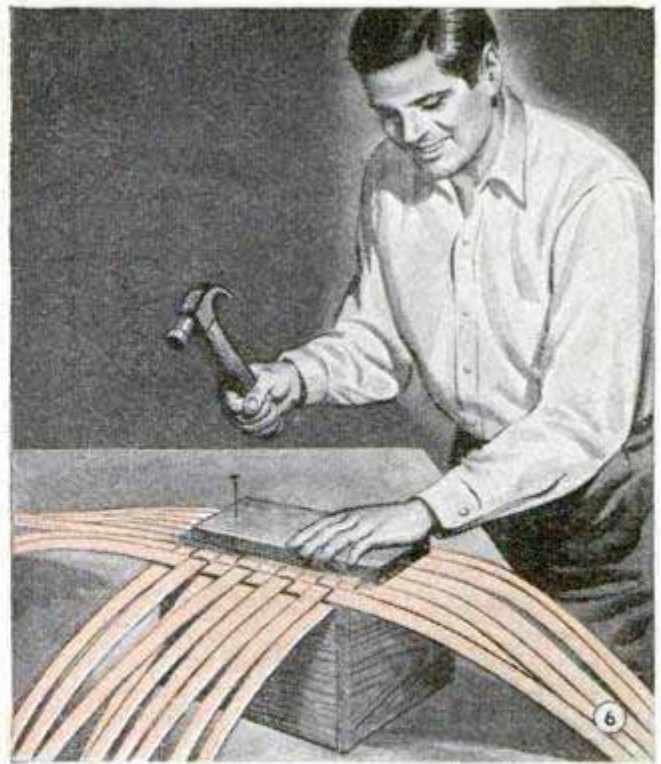
A neat sewing basket, suitable for many other uses, is made as illustrated in the center detail, Fig. 5. There are two methods of starting the bottom of such a basket,

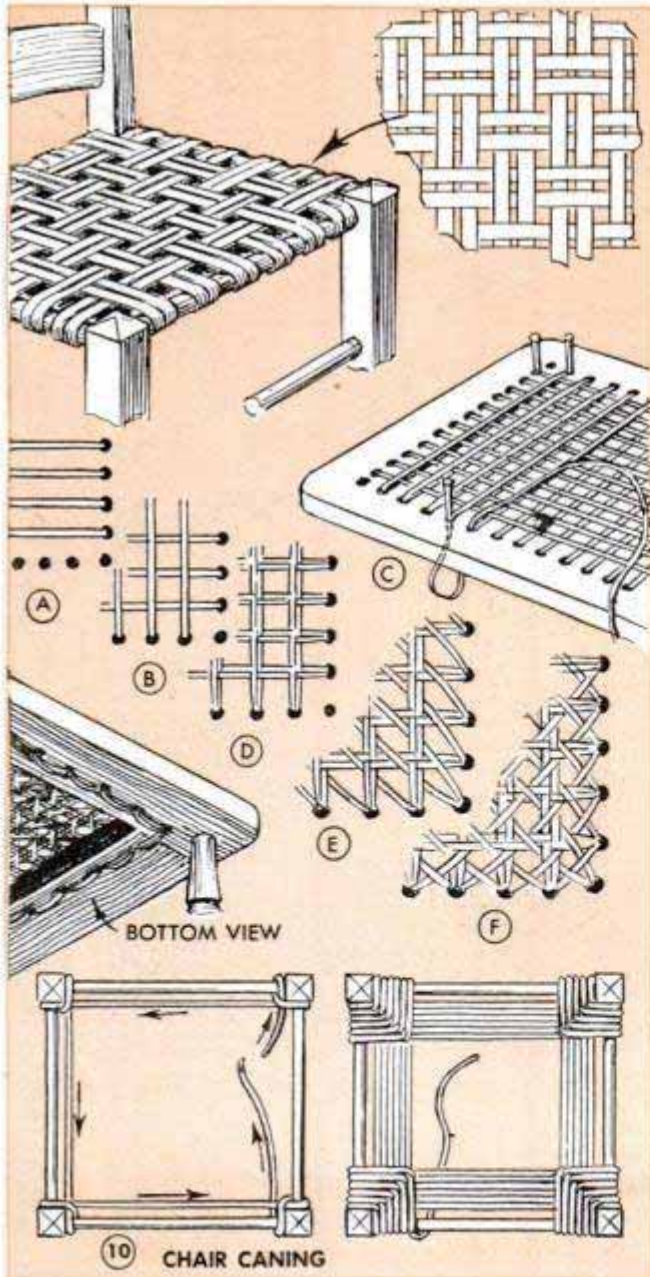


one in Fig. 2, the other in details A, B, C and D in Fig. 5. Employing the latter method, use reed sticks and a bundle of raffia. Cut four of the sticks 6 in. long, and with a sharp knife make slits in each at the center, 1 in. long. Cut four more reeds the same length, sharpen the ends and insert in the slits of the other four as in detail A. These are known as spokes and form the base of the basket. Bend the ends slightly downward so that the finished base will be concave and stable on a flat surface. Double a strand of raffia at its center and put it around one of the groups of four spokes, one in front and the other strand behind as in detail B. Work around the groups of four spokes in twined weaving four times around. Then separate the spokes into pairs and weave around again four times as in detail C. Space all the spokes evenly and continue weaving another four turns, making the complete base. Push the raffia toward the center and cut off the ends of the sixteen spokes. With an awl force an opening between the top and bottom strands, each side of every spoke, and insert sharpened reeds, pushing in as far as they will go, detail D. These form the ribs. Pinch the reeds at the base or close to the circular rim of the bottom, and bend up all 32 new ribs. Continue weaving until the wall is finished, leaving about 2 in. of each rib projecting. The top ends of the spokes are bent down and bound in place in the rim.

Another easily made basket suitable for heavier loads is shown in the lower right-hand details of Fig. 5. Six long, thin wood splints, 2 in. wide, are laid one over another, spoke fashion, riveted in the center and bent up over a large pot lid, wooden disk or whatever suitable object is handy. Heavy cord or other material is then woven around the upright splints, and the top ends are riveted to a doubled strip of heavy canvas. A rope or splint handle passing entirely around the basket completes the job.

Still another similar type of basket, heavy and exceptionally strong, is made by beginning with a number of splints woven at right angles over a box slightly smaller than the base area of the basket as in Fig. 6. Lay the woven splints on top of a box and fasten with a board nailed to the bottom of the box as shown. Next, bend the splints down all around and begin weaving the walls carrying these up to a height of three or four splints as in Fig. 7 and detail A of Fig. 8. Then the box can be removed and the tops of the splints held in place by a cloth strip, detail B. Next, point the end of each splint and when the basket is as high as you wish, bend these ends over and tuck into the horizontal splint which is





second or third from the top as the case requires, detail C. Make a rim of hickory, roughly trimmed to a half-round section. Lap and rivet the ends and fasten to the basket top with thin splints bound around in one direction, then other splints bound the other direction, so that they cross as in detail D. The ends are tucked under as in Fig. 9. Some weavers make hickory splints as in Fig. 1, but usually it is better to buy the splints ready-made.

Woven chair seats can be made from rawhide strips, twisted cattails, cord or rope and the old favorite, cane. A very simple rawhide job is illustrated in the upper details, Fig. 10, the strips being woven in pairs and the ends tied. Use the longest things you can obtain, and moisten them slightly so that they will be taut when dry. Don't soak the things, as in drying they may shrink and crack the rungs over which they are stretched.

Cane is commonly used in chair bottoms. A simplified pattern for the beginner is given in Fig. 10. This is easy to follow and makes a substantial seat. The conventional pattern is carried out in the various steps as shown in details A to F inclusive, Fig. 10. Holes are evenly spaced and the cane strip is brought up through a hole, second from the corner, and secured with a tapered wooden peg. Front-to-back strips are installed first, detail A, and then those at right angles, or crosswise, are completed over the first ones, detail B. Again continue with the parallel front-to-back strips and over these, the second layer of crosswise strips, detail D, securing the ends either by tying underneath or driving in a hardwood peg and cutting off the projecting end flush with the chair frame. On the diagonals the work becomes somewhat more complicated. All those running in one direction are installed first. They are followed with the strips running at right angles to the first set of diagonals. See details E and F. The cane should be soaked a short time before using, but be careful that it is merely damp, not wet. This is quite important in successful weaving.

Rush chair seats are made of dried, twisted cattails and, of course, substitutes are used. If you use cattails, cut them at the peak of growth. Dry them in a dark place and before twisting, soak in water. Ends of the reeds or stems can be joined in a square knot made only on the underside of the seat. This procedure is shown in the lower details, Fig. 10. Begin at the corners of the chair frame and work toward the center, twisting the material as you go. Before closing up the seat at the center pack the empty space between upper and lower strands with scraps of the same material to make a solid seat.

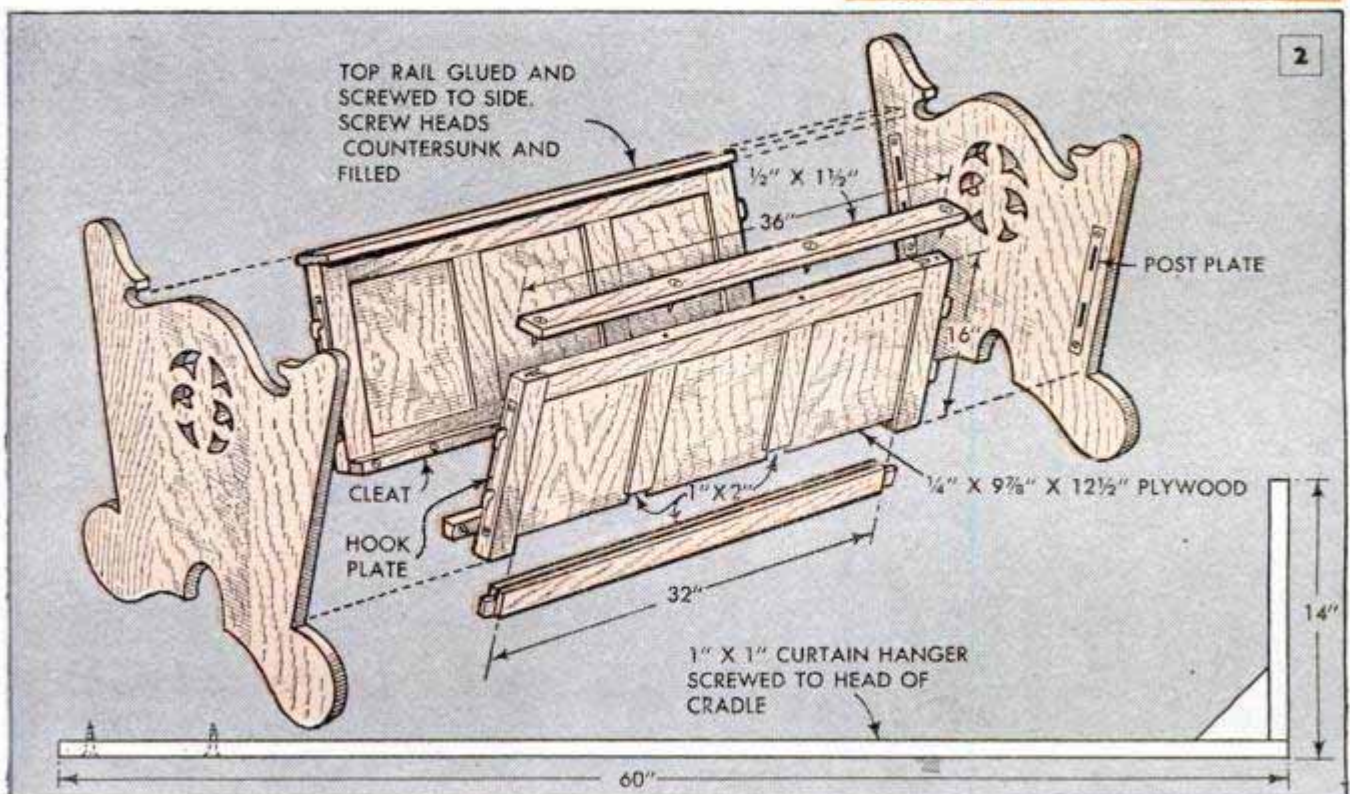
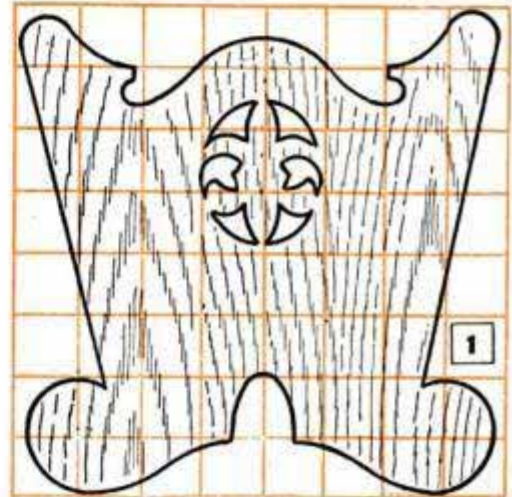
DUTCH CRADLE

PATTERNED after an original in Holland, this reproduction of an old Dutch cradle offers something unusual in a baby's bed. Its quaintness is typified by a curtain hood, originally provided to protect the baby from drafts. The sides are attached to the head and foot like the rails of a bed, using fasteners taken from an old bed, or purchased. Plywood, $\frac{3}{4}$ in. thick, will save gluing up solid stock for the head and foot pieces. The pattern for these, Fig. 1, can

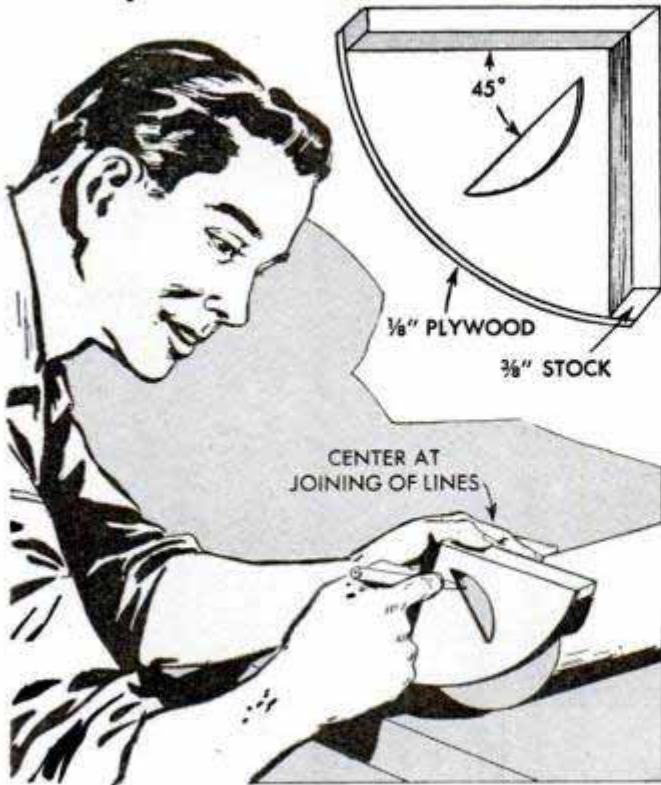


be enlarged to suit; 4-in. squares will increase the pattern to the size of the original, but 3-in. squares will make it somewhat smaller and less difficult to handle when sawing. While a bandsaw is the tool to use, the work can be cut by hand with a keyhole saw.

Assembly of the bed is detailed in Fig. 2. Note that the sideboards are paneled and fitted with cleats on the inside to support slats or a spring. The cutout design in the head and foot can be simplified by boring seven holes in a circular pattern. Use an expansive bit and make clean-cut holes by backing the work with a scrap block or boring from each side. The bracket that supports the curtain is screwed to the head.—C. J. Stork, Utrecht, Holland.



Marking Jig Locates Centers On Square or Round Stock

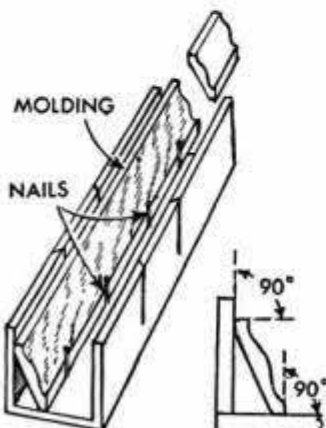


This jig makes quick work of locating and marking centers on square or round stock. To make it, cut a 90-deg. segment on a 5-in. radius from 1/8-in. plywood. Saw a half-moon opening in the segment with the straight side of the opening bisecting the 90-deg. angle. Then miter the ends of two pieces of 3/8 by 3/4-in. stock and glue and brad these pieces to the plywood segment. To use the jig, place it on the end of the stock and draw a line along the straight edge of the opening with a sharp pencil or scribe. Move the jig approximately 90-deg. and scribe another line intersecting the first. The center of the stock will be at that point where the lines intersect.

J. Harold Click, Elkin, N. C.

Sawing Cove Molding

With this simple miter-box setup, it is easy to cut accurately fitting joints in cove or crown molding wherever it is necessary



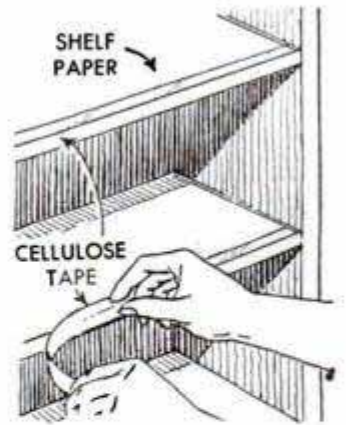
to make a miter joint. It is done by placing the molding at the same angle in the box as it will be when nailed to the wall and ceiling. Finishing nails driven into the base of the box hold the molding in the correct position. When sawing, be

sure to hold the molding firmly against the box to insure an accurate cut.

Aldo Gotta, Jamaica, L. I., N. Y.

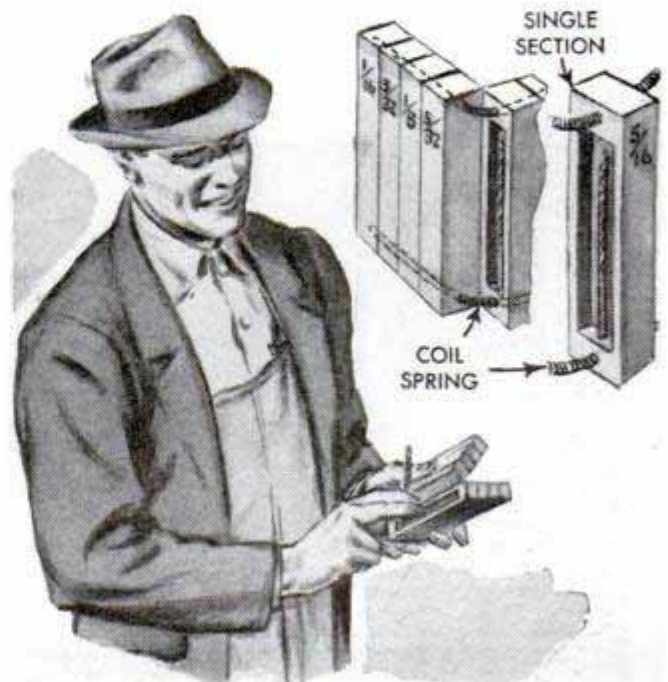
Cellulose Tape Holds Shelf Paper

Thumbtacking shelf-lining paper to cupboard or pantry shelves often results in the paper shifting and tearing at the points where it is held by the tacks. This will not occur if cellulose tape is used instead of thumbtacks. Simply apply half the width of the tape to the front edge of the paper and stick the other half to the edge of the shelf as shown. When shelving paper is used which has a decorative edging, small tabs of tape can be applied at each end and across the back to hold it.

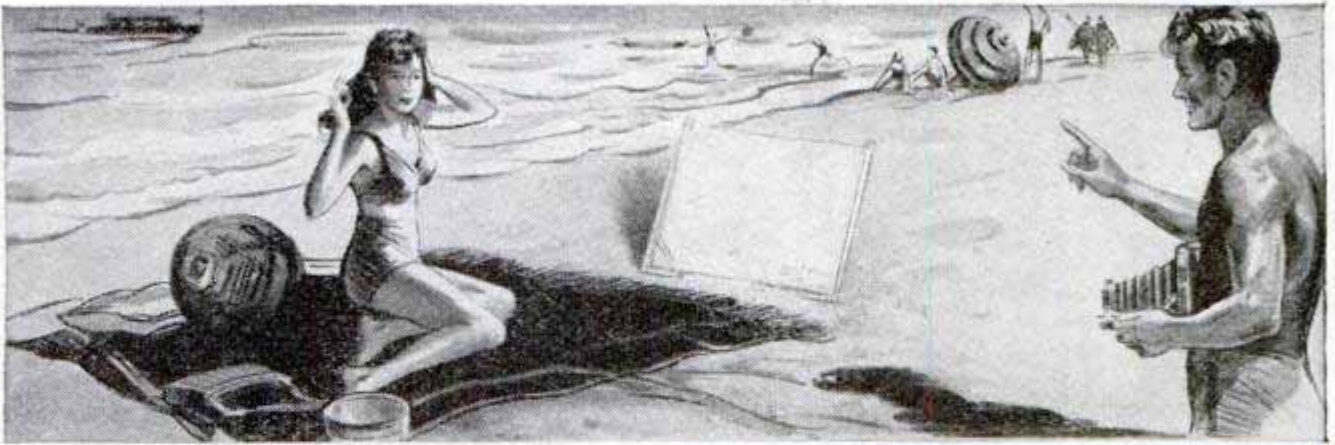


Sectional Holder for Small Drills Carried in Pocket

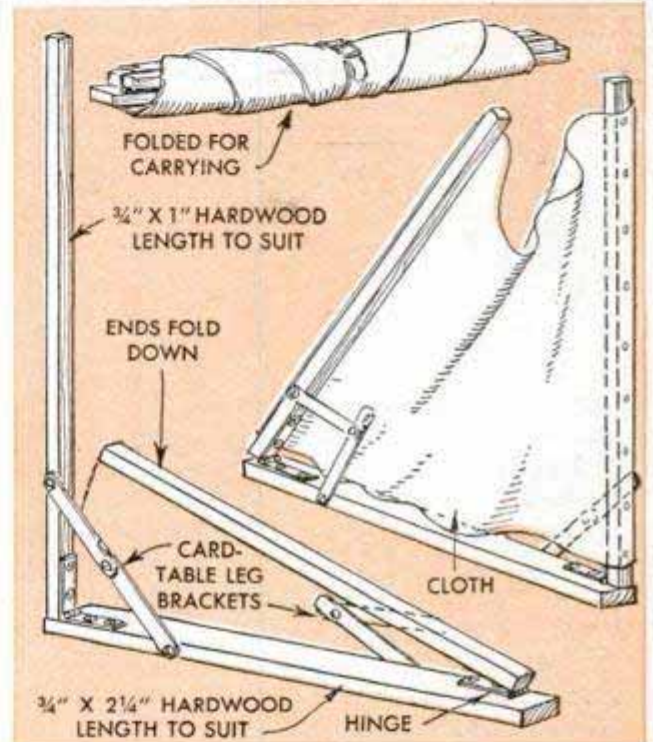
A number of small twist drills can be carried in a pocket without tearing the cloth or dulling drills if this sectional holder is used. Each section consists of a wooden block that is hollowed out to hold a drill. The sections are held together by small coiled springs running through holes near the top and bottom of each section. Drill sizes are printed on the blocks for ease in selection. Note that a blank strip or block attached to the springs is required to cover the opening in one end block.



Collapsible Reflector for Outdoor Photographs



As an aid in taking photographs outdoors under natural lighting conditions, this portable reflector will enable you to direct the light wherever desired. In addition, it is useful indoors with either flash or photo-flood lighting. It can also serve as a wind-break when taking photos of flowers or other fragile objects. The reflector is merely a piece of white cotton cloth tacked to a three-sided wooden frame, which consists of three hardwood pieces, two arms and a base. These are hinged to fold compactly, card-table brackets being used as indicated to keep the reflector in the open position. If the brackets are not available, screen-door hooks and screw eyes can be substituted for them. A strap, fastened around the center, holds the reflector in a neat bundle. Keep the reflector close to the subject, as light intensity diminishes greatly with each foot of intervening distance.
Austin Phelps, Omaha, Nebr.



Hand Holes Cut Quickly With Dado Saw

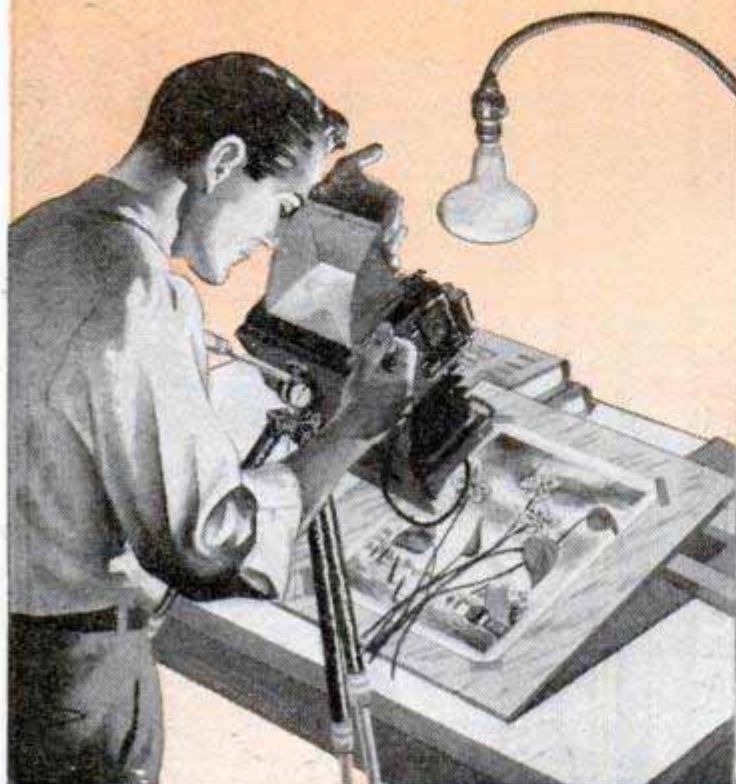
Here's a simple production jig for cutting hand holes quickly and accurately in box ends, desk slides, breadboards, etc. It's done with a dado saw in the following manner: A wooden frame to position the work is made to suit the job at hand and is clamped to the top of the saw table. Then, the dado saw is set at the desired height, the heel of the work is placed in the corner of the frame and the work is lowered over the rotating saw. If the height of the dado saw is less than the thickness of the work, a blind hand hole is cut. If it is greater, an open-type hand hole is produced. Where the job requires a rectangular opening it can be squared up afterward with a jigsaw.

Joseph Ruel, Fifty Lakes, Minn.

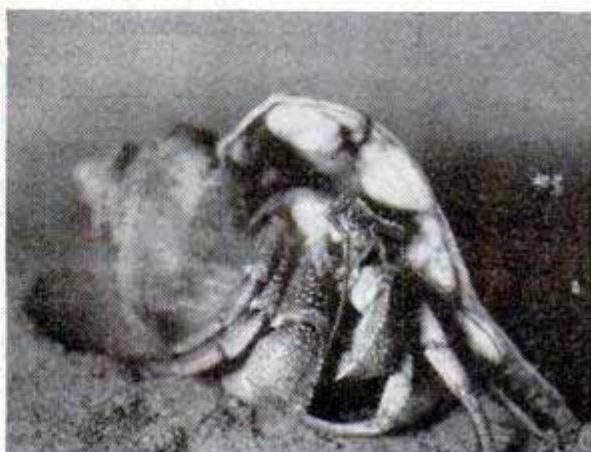
☞ An old toothbrush, dipped in a saucer containing moistened baking soda, is handy for cleaning silverware or costume jewelry.

TABLE-TOP STUDIO for NATURE PHOTOS

By Paul Hadley



Obviously, this toad wasn't asked about having his picture taken. But here he is. The lens was only an inch or so above his own eye level

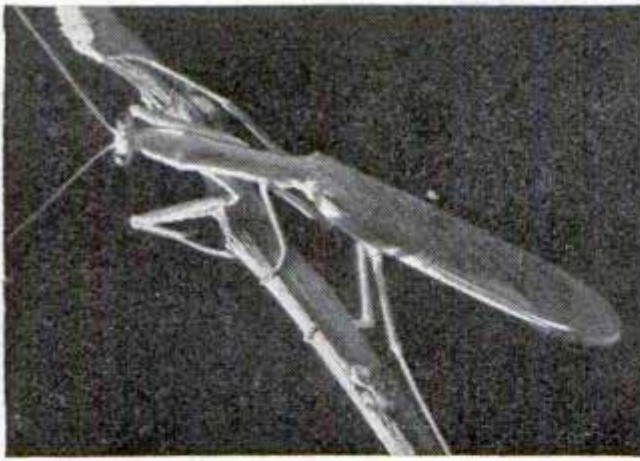


Sand spread on the worktable makes this hermit crab look and feel right at home. One floodlight gives the effect of bright sunlight



NATURE students who take close-up photos of live subjects for study purposes will find a simple indoor table-top studio most helpful in making these difficult shots. In this way, the subject can be placed at a convenient height and posed with props that simulate the characteristics of its natural habitat. As a rule the live subjects can be photographed on a table top with far less difficulty than one would experience when attempting to take the same shot outdoors in natural surroundings, for indoors both the lighting and the subject can be controlled.

Any worktable with a top that will not be damaged by building up sand, grass or mud props for use with various subjects will do. The standard table height of 30 in. is suitable for average work, where an adjustable camera tripod with tilting head is used. The photos show what can be done with the simplest setups. Backgrounds may be varied, of course, but a white one is most useful, as it closely represents the sky if kept



Sunlight coming through a window lighted this table-top shot of a praying mantis perched on a twig in a characteristic pose. Use a dull black background



Weeds "planted" in a bed of lawn clippings spread on the table top make a realistic background for this shot of baby rabbit. Camera is above subject



A fearsome creature, this huge beetle, especially when the shot is taken close-up from a low angle, which tends to accentuate the size of the subject



This baby blue jay, just sprouting his wing feathers, was easily induced to pose indoors for a table-top shot. Note the low angle. Background is crepe paper

free from shadows. A large cloud print makes a good natural background for close-ups of flowers. When photographing these, care should be taken in arranging the lighting to avoid unnatural shadows. In most cases, a single floodlight will give the necessary light intensity. The light should be placed directly over the subject and the camera elevated on the tripod and so located that the shadows do not register on the ground glass. Usually, flowers photograph best when placed on a tilted easel as shown in one of the illustrations. A large cloud print placed under the subject makes a realistic background. Being so nearly in the same plane as the subject, detail in the background print will be sharp, so it should be located carefully.

Photos of the sleepy toad and the hermit crab on the opposite page were made by spreading sand on the table and placing the subject on it in a realistic pose. In both these shots the camera was lowered to a point just above the eye level of the subject. Two of the other photos shown, the large beetle and the fledgling blue jay, were made with the camera below the eye level of the subject. The shot of the bird

perched on a flowering twig, was taken against a background of white crepe paper. In the photo of the praying mantis, a dark background was used, and extremely brilliant lighting was obtained by placing the subject in bright sunlight streaming in through a window. Several weeds pulled from the garden and "planted" in a bed of lawn clippings gave the proper background realism for the shot of the baby rabbit. Note the side lighting.

Live fish and other water creatures, also water plants, can be photographed on a table top by placing them in a large glass tank or aquarium filled with clear water. To prevent live subjects from getting out of focus by swimming away from the side of the tank, use a piece of glass just large enough to slip inside the tank lengthwise and block it in place a couple of inches back from the front surface through which the pictures are to be made. Placing the subjects in this restricted area will keep them in focus. Due to the necessary open lens setting and the slow exposure time which must be used when taking close-ups, wait till the subjects come to rest in a natural pose before tripping the shutter.



6 FT.

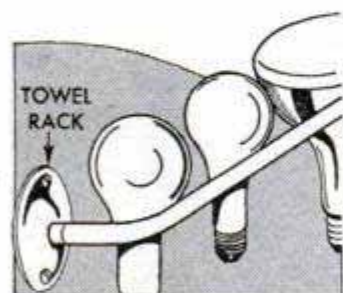
12 FT.

24 FT.

Reflecting View Finder on Camera An Aid When Focusing

Most folding cameras have a reflecting view finder that can be used to determine distances when focusing. To do this, select a subject—preferably a person of average height—and frame him in the finder so the image from the waist to the top of his head covers the glass. Next measure the distance from the camera to the object. Repeat the process, framing the person from head to foot, and then have him far enough away to fill half the finder. With these three distances known, it's easy to interpolate in between and set the scale on the camera accordingly. When focusing pictures, select a person or object of about the same height and you will be able to set the camera within close limits.—Bob Hurst, Chicago.

Storage Rack for Photo Bulbs



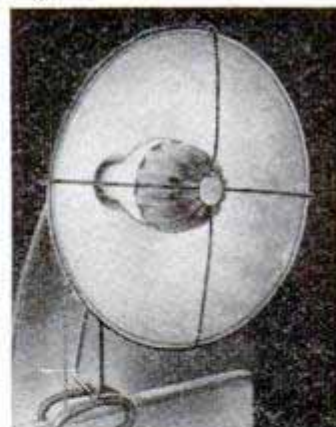
This storage rack will hold almost all sizes and shapes of photographic bulbs, and it will keep possible breakage at a minimum. It consists of an ordinary towel rack long enough to hold the bulbs you have. Several racks can be located in the studio so that a large assortment of bulbs will always be close at hand when needed.

Alexander Maxwell, Chicago.

Molding Cup Used as Light Diffuser

A molding cup of the kind used for gelatin salads provides an efficient diffuser for No. 1 photoflood bulbs to furnish a more even illumination. Punch four holes near the bottom of the cup and insert two wires crosswise, hooking them to the edge of the reflector. Stiff wire, such as is used in coat hangers, will do.

H. Klein, Pittsburgh, Pa.



Labeling Chemical-Solution Bottles

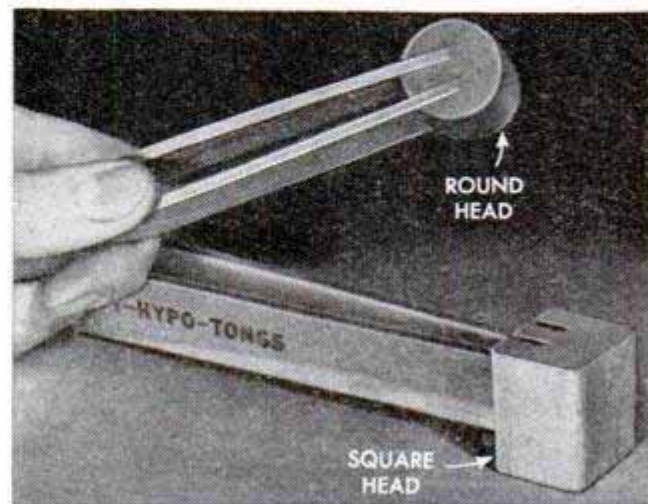
Identification of bottles containing photographic solutions is both permanent and positive if the name is written on the glass with a hand power tool and an abrasive wheel. The writing will stand out clearly regardless of whether a transparent or dark-colored bottle is used.



Although photo-print tongs may be lettered "hypo" and "developer," it's easy to get them mixed up in the darkroom and find that the hypo tongs are in the developing solution and vice versa. One way to avoid confusion is to use tongs that have differently shaped heads. For example, developer tongs could have a round head and hypo tongs a square one.

Positive Identification of Print Tongs

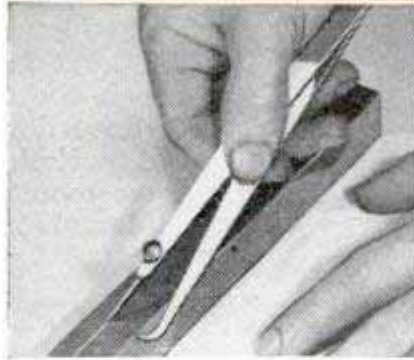
R. F. Donavan, Jersey City, N. J.



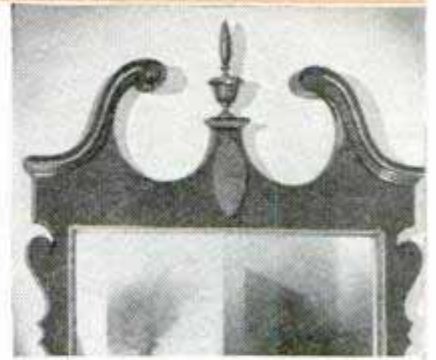
CRAFT QUIZ



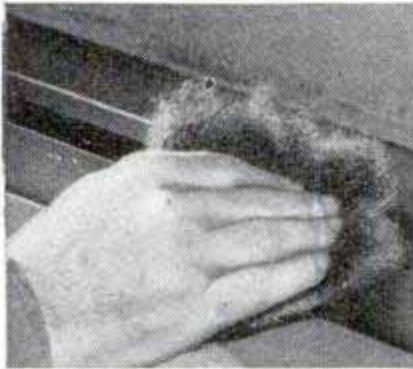
1. Joint being made is—
 (a) Butt miter (c) Doweled miter
 (b) Box miter (d) Keyed miter



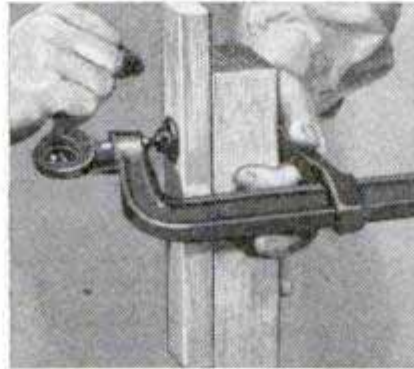
2. Nickname for this caliper is—
 (a) Jenny (c) Peg leg
 (b) Lizzie (d) Dingbat



3. This mirror has a turned—
 (a) Filial (c) Gallery
 (b) Apron (d) Finial



4. Medium steel wool is—
 (a) No. 2 (c) No. 00
 (b) No. 1 (d) No. 0



5. Clamp used here is—
 (a) Shielded (c) Concentric
 (b) "C" (d) Eccentric



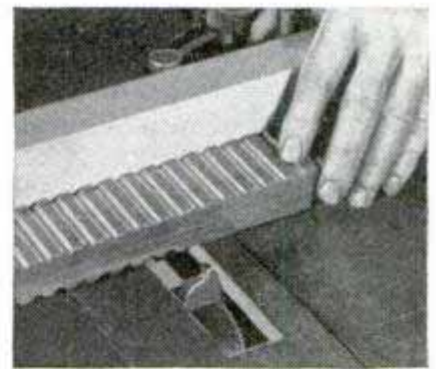
6. He would know about—
 (a) Burls (c) Taper turning
 (b) Planimeters (d) Broadheads



7. Light finish on oak is—
 (a) Limed (c) Bog
 (b) Fumed (d) Mission

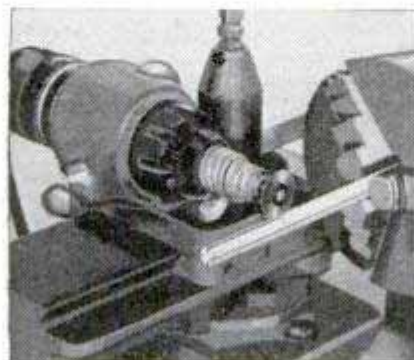


8. This room will have a—
 (a) Plate rail (c) Crown mold
 (b) Drop ceiling (d) Bay window

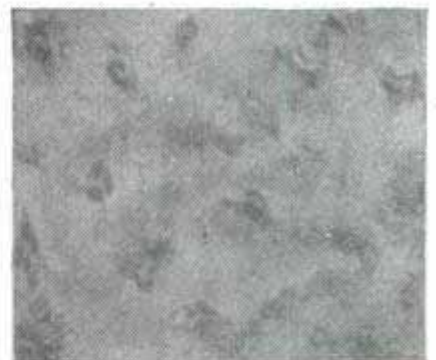


9. He is using a—
 (a) Molding head (c) Dado head
 (b) Cope cutter (d) Safety head

ANSWERS: 1—c; 2—a (also odd leg; true name, hermaphrodite caliper); 3—d; 4—b (No. 2 is medium-coarse); 5—d (clamps with eccentric movement of handle); 6—a (picture shows press frame used in making veneered panels); 7—a (also called frosted); 8—b (ceiling color or paper dropped down on sidewall); 9—a; 10—d; 11—c

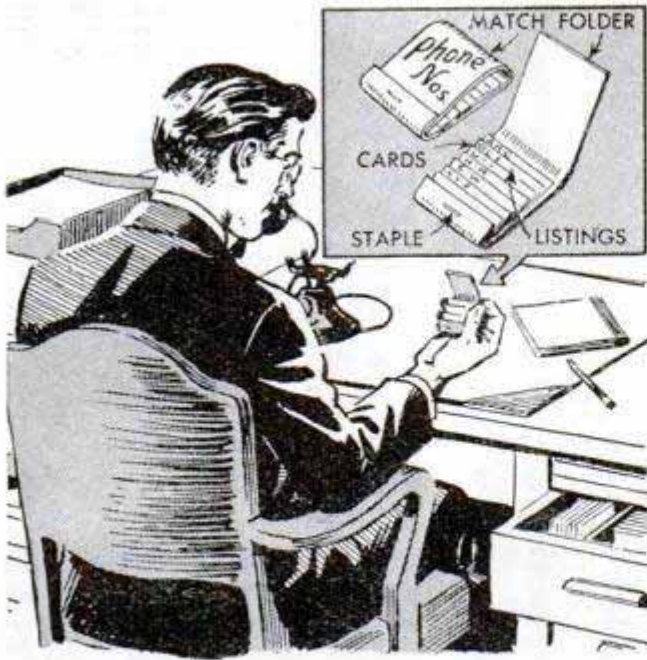


10. Simple lathe has a—
 (a) Flat bed (c) Cone drive
 (b) Change gears (d) Index head



11. Wood figure shown is—
 (a) Ribbon stripe (c) Bird's-eye
 (b) Quilted (d) Fiddleback

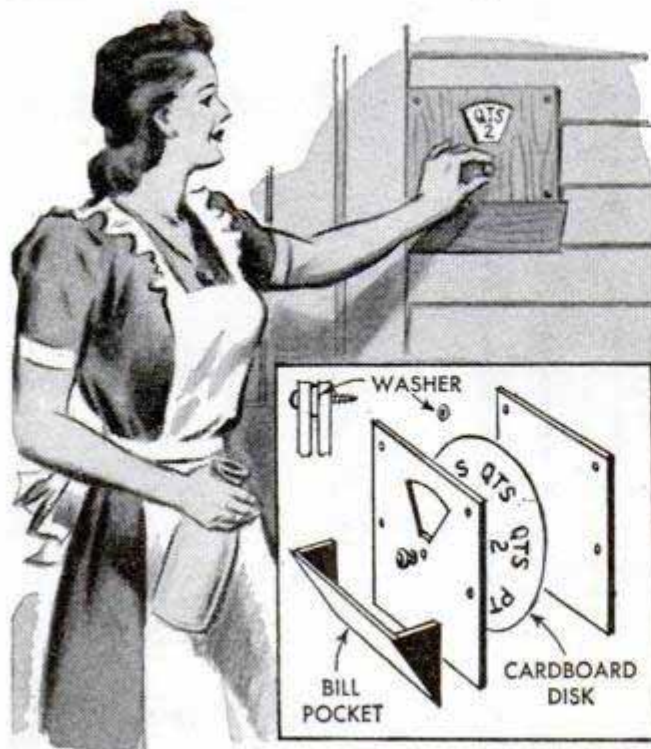
Vest-Pocket Phone Directory Made From Match Pad



Just the right size to carry in a vest pocket, a book of matches can be converted into a handy little pad for phone numbers called frequently. Simply remove the wire staple and replace the match stubs with several little cards. Cut each card about $\frac{1}{8}$ in. shorter than the next one as shown to provide space for listing the numbers, and then restaple as before.

Indicator That Has Rotating Disk Shows Amount of Milk Needed

This indicator, which shows at a glance the amount of milk or cream needed, does away with the necessity of having to leave a note for the milkman each day. The front



and back pieces or panels are made of lightweight plywood and the rotating disk is heavy waxed cardboard lettered to show the amounts of milk or cream required. Cut a window in the front panel, and use a metal knob and spindle to rotate the disk. The unit is assembled with washers between the front and back pieces so the cardboard will be free to turn. Note the bill pocket, in which the milkman can leave monthly statements.

Margaret E. Singleton, Rochester, N. Y.

Wallpaper Blister Pasted Down

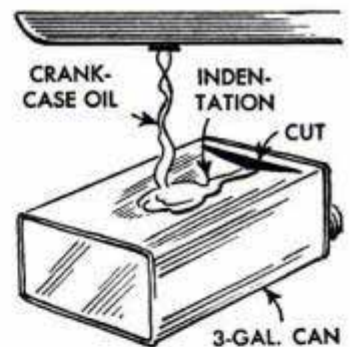
Unightly wallpaper blisters may be pasted down by using an ordinary eye dropper that has been filled with liquid glue. Slit the blister horizontally near the top and insert the tip of the dropper to spread glue over the plaster. Then press the paper down with a piece of cloth. Avoid staining the paper by applying too much glue.



Container for Crankcase Oil

With this container, oil is drained from an auto or tractor crankcase and stored in the same receptacle into which it is emptied. This does away with the necessity of handling the oil several times, and it also permits draining without raising the auto or having to use a funnel. Cut a slit in the wide side of a 3-gal. can near the top and press the side in to form a V-shaped indentation or trough. Set the can under the auto so that oil will drain into the trough. Then set the can upright when storing it, after first determining that the oil level is below the slit.

Harold A. Nelson, Minneapolis, Minn.



"Pick" to Clean Small Oilholes

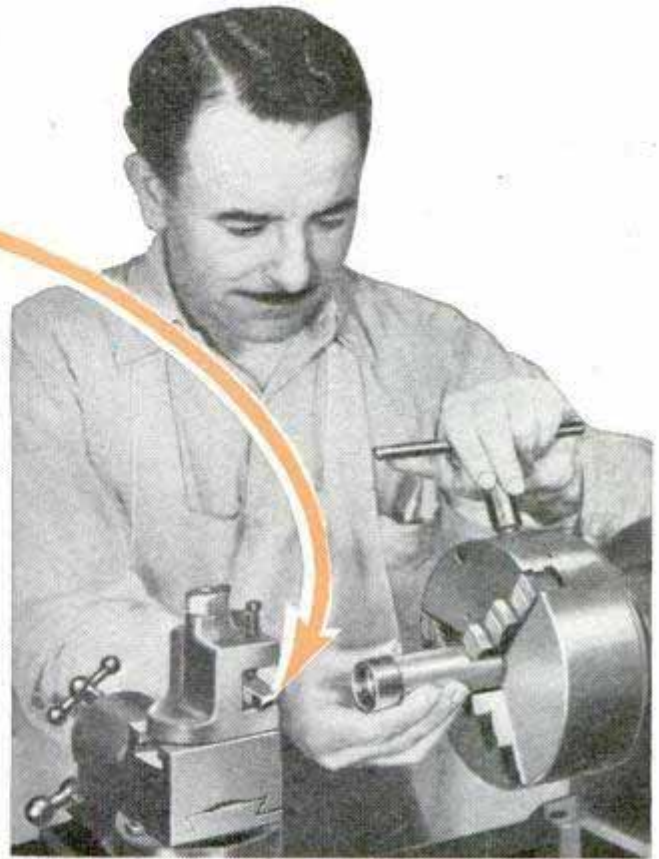
To clean small oilholes and similar openings, use one of the filament-supporting wires from a discarded 60-watt light bulb as a pick. Break the bulb and remove the glass adhering to the base, which then serves as a handle. Leaving the stem intact, remove all but one supporting wire.



Turn it with Carbide Tools



Photo courtesy Carbology Co.



IF YOU have had the edge of a high-speed bit fold up when making the first "skin" cut on cast iron, you'll appreciate the way a carbide-tipped tool peels off the metal. This high-production cutting tool of industry can be put to work in the small machine shop as well as the home workshop. For besides being used in a tool post, it can be used freehand like a wood-turning chisel, Fig. 9, to turn brass, aluminum and plastics at wood-lathe speeds. Once ground and sharpened, carbide tools will stay sharp longer than any other cutting tool. They require only light honing at long intervals with a silicon-carbide stone to maintain the edge. Tools tipped with carbide can be purchased, or you can assemble chisels as shown in Figs. 10 and 11.

What is cemented carbide? The sketch at the bottom of the page explains cemented tungsten carbide graphically. The full-name description often is shortened to just "carbide." Cobalt is the bonding or cementing agent that binds the particles of tungsten carbide into a compact mass, which closely resembles polished steel. This metal is super hard—it scratches glass, Fig. 1, and it will cut the hardest file. Like all very hard materials, it tends to be brittle and will not stand excessive shock loads. By adding a greater proportion of cobalt, hardness is reduced slightly and toughness is increased. There are two main groups of carbide tools: The straight tungsten carbides, as already described and illustrated, and the combined

**CHROME STEEL
H. S. STEEL
HARDENED
TOOL STEEL
MARBLE
ETC.**

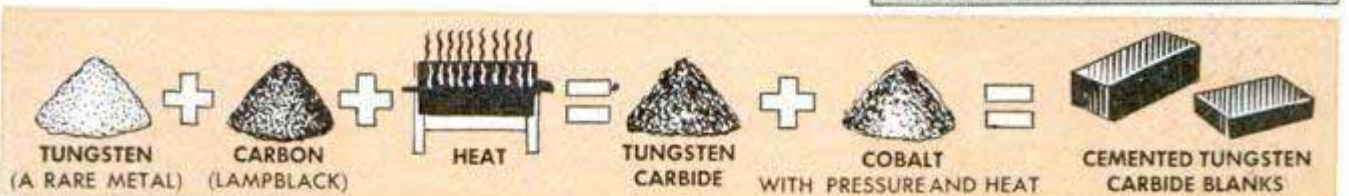
USE CARBIDE . . . FOR TURNING ALL SUPER-HARD MATERIALS

**FIBER
PHENOLICS
LAMINATES
HARD RUBBER
ASBESTOS
ETC.**

USE CARBIDE . . . FOR ALL MATERIALS HAVING AN ABRASIVE ACTION

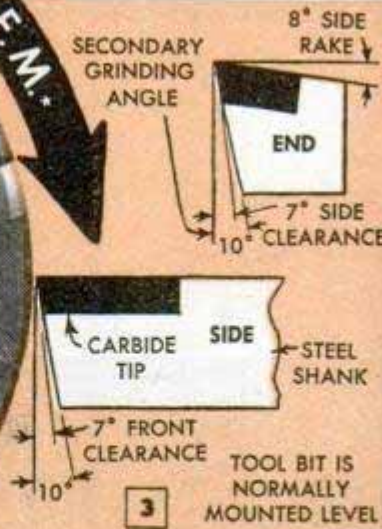
**BRASS
COPPER
MILD STEEL
ALUMINUM
ZINC**

USE HIGH-SPEED STEEL . . . FOR AVERAGE TURNING UNLESS YOUR LATHE IS POWERED WITH AT LEAST 3/4-HP. MOTOR





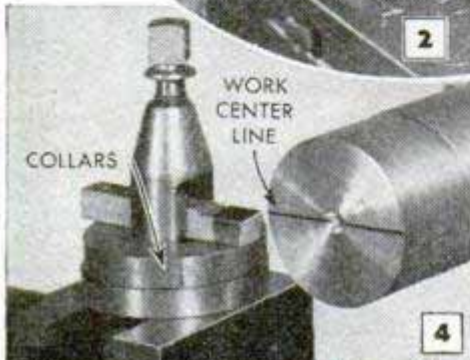
* SURFACE FEET PER MINUTE



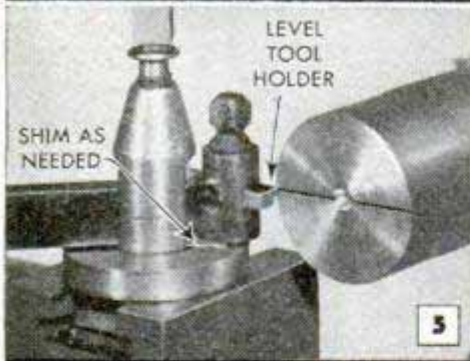
200 S. F. M.	
WORK DIA.	R. P. M.
¼	3056
½	1528
¾	1016
1	764
1¼	612
1½	508
1¾	436
2	382
2½	306
3	254
4	191
5	153

WORK 6" TO 12" DIAMETER CAN BE RUN AT 100 R. P. M.

A rule-of-thumb speed for carbide tools is 200 s.f.m. Table at right converts this to r.p.m.



¾" AND ½" BITS CAN BE MOUNTED DIRECT IN TOOL POST



STANDARD TOOL BIT SHOULD BE USED IN LEVEL-TYPE HOLDER



POSITIVE RAKE IS RECOMMENDED FOR LIGHT CUTTING

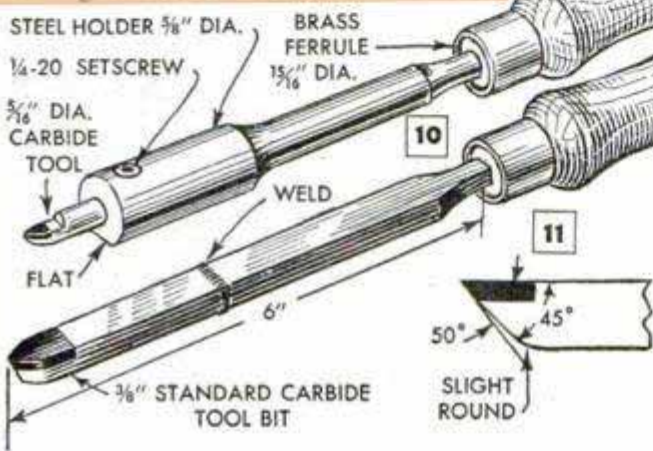
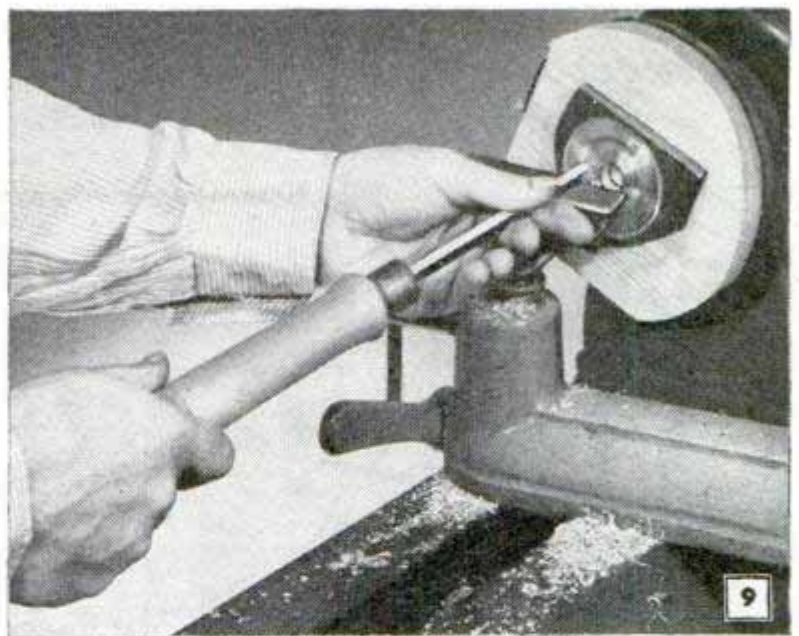
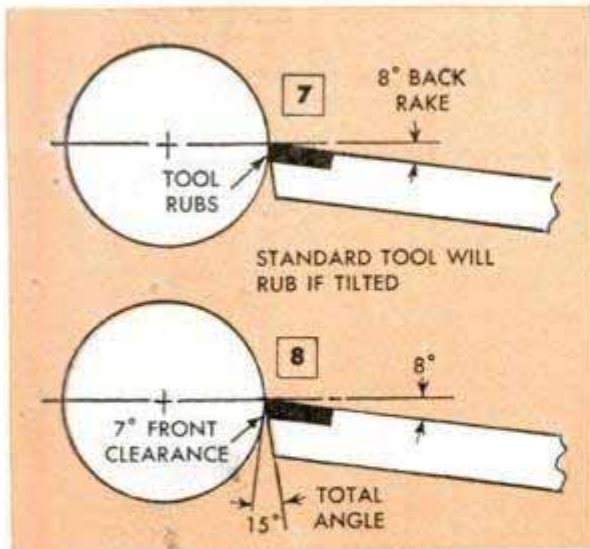
carbides, which are tungsten carbide with titanium or tantalum added. The straight tungsten carbides are used for turning all materials except steel; the combined carbides are used for steel only. The difference is that steel tends to stick or build up on straight tungsten carbide, and the addition of tantalum or titanium helps to overcome this fault. However, for light turning, any kind of carbide tool can be used successfully on any type of material.

What can carbide do? Being extremely hard, carbide turns all materials at high speeds not possible with other cutting tools. Consider a sample job: In turning 1-in. mild steel it is an easy job for carbide to turn this at 300 ft. per minute with a .010 feed and 1/8-in. depth of cut. In other words, with the lathe running at 1150 r.p.m. the tool will peel off 4½ cubic inches of metal per minute. But such a heavy cut requires a lathe powered with a 2½-hp. motor. As the average home-workshop lathe is powered with a fractional-horsepower motor, it is apparent that the full cutting capacity of carbide cannot be utilized as even a high-speed steel bit will tax the capacity of the motor.

However, there is another side to the picture. Very often you will encounter a hard piece of steel which resists turning with high-speed bits. A good example of this is where a broken high-speed drill with Morse shank is turned down to make some other tool. That's where you can use carbide. Again, take a seemingly simple job like turning a ring in phenolic plastic. Most of these plastics are filled with metal, asbestos, wood flour or other material, all very abrasive and quick to turn the edge of carbon or high-speed steel tools. Here, again, the carbide tool does the job perfectly.

Carbide is excellent, too, for turning cast iron. Cast iron does not offer the resistance of steel, hence a fair bite can be made with the work running at 200 s.f.m.

How is carbide used? Just forget you have anything special in the way of a tool bit and use carbide the same as you would high-speed steel. Assuming your



1 1/8" DIA.
 MAPLE HANDLE ABOUT 10" LONG OVER ALL
 HAND TOOLS CAN BE USED TO ADVANTAGE ON SPEED LATHE. PHOTO SHOWS ALUMINUM BEING TURNED AT 900 R. P. M.



GRINDING IS PREFERABLY DONE FREEHAND AND DRY ON SUITABLE GRINDING WHEELS

power is no greater than a 1/2-hp. motor, it is impossible to overtax carbide with any combination of speed and feed which the motor will pull. A good rule is, "200 feet per minute," and the table adjacent to Fig. 3 converts this to r.p.m. Ready-sharpened tool bits, available in various sizes and shapes, are intended to be mounted on-center and horizontal as shown in Fig. 3. Figs. 2, 4, 5 and 6 show various mountings. Although industry uses the standard shape, Fig. 4, best results on light equipment are obtained if tool-bit angles closely pattern those of high-speed steel. A good setup is shown in Fig. 7 where the tool is given 8 degrees back rake by the angle of the tool holder. In this case, it is necessary to provide more front clearance, as can be seen in Fig. 8.

How is carbide ground? Use a silicon-carbide wheel for grinding the tip, Fig. 12, and forget anything you may have heard about carbide being tough to grind. True, it is a super-hard metal and grinds slowly, but if you keep the tool moving to grind off small facets, the carbide wheel does the trick quickly. Double angles are commonly used in grinding carbide bits. Grind the tip at the required angle and then back off

the metal shank an extra two or three degrees. With this system, light sharpening can be done on the silicon-carbide wheel without running into the shank. Use an aluminum-oxide wheel if it is necessary to undercut or grind the shank.

Hand tools: Carbide hand tools do excellent work in turning brass, aluminum and plastics, as in Fig. 9, and can be purchased ready-made in square and round-nose patterns. It is also practical to make your own tools from standard tool bits, as shown in Figs. 10 and 11. Once ground and sharpened, these turning tools will stay sharp indefinitely and require only light honing on a silicon-carbide oilstone.

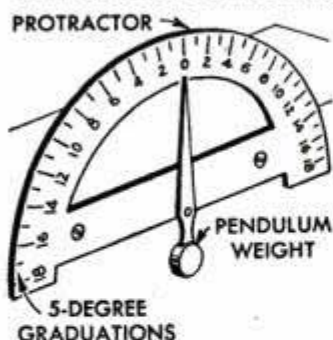
Shadow Screen for Copying Speeds Painting Signs



With this shadow screen, any number of duplicate paper or cloth signs can be hand lettered quickly from a master pattern. It consists of a wooden frame which is covered with screen wire and then hinged at a convenient slant to a wall. A large light bulb illuminates the screen from behind. In use, a master pattern of the sign is made and thumbtacked to the screen wire. Then, the cloth or paper sign material is placed on top of it. When the light is turned on, the lettering of the master pattern will show through from the back in silhouette outline, making it an easy job to copy.

Otto Woolley, Colorado Springs, Colo.

Gradometer Made From Protractor



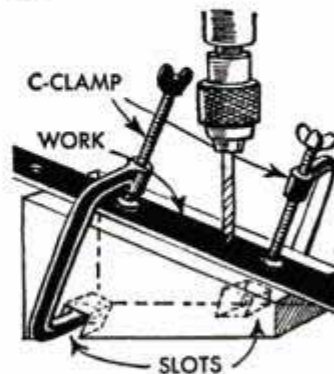
Here's a way to make a simple gradometer for measuring the incline of grades and slopes, and determining the fall of short runs of drain tile, water pipe and open ditches. Obtain a

draftsman's metal protractor, turn it over on a flat surface with the graduated side down. Next, lay off and mark a new set of graduations 5 deg. apart and number each mark as shown to represent the number of inches of rise per foot. Fasten a weighted metal pointer at the center index mark of the protractor, using a hollow rivet peened lightly so that the pointer will swing freely. Screw the protractor to a

mason's wooden level in such a position that when the spirit bubble shows level, the swinging pointer registers exactly zero on the protractor scale. Each 5-deg. division on the scale indicates an incline of approximately 1 in. to the foot. This is accurate enough for average work.

Drill Vise Takes Place Of Nontilting Table

Where it is necessary to tilt the work on a nontilting drill-press table, a simple work holder consisting of a wooden angle block fitted with two C-clamps will permit angle drilling. The block is



angle-cut to correspond with the angle of the hole to be drilled, that is, to drill a hole at a 60-deg. angle, the block must be cut at a 60-deg. angle. Notches in the block recess the clamp pads so that the block will set flat on the drill-press table.

Short Pencil Leads Salvaged To Use in Compass

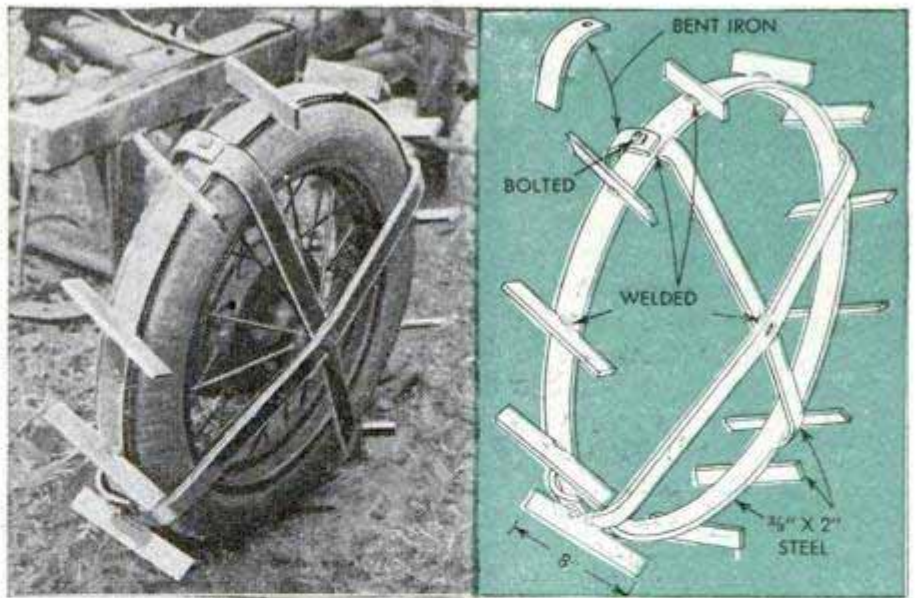
Many draftsmen salvage short pencil leads for use in their compasses or bow pencils. A convenient way to keep these leads at hand is to attach them to the tacky surface of a strip of adhesive tape, which is fastened to the side of an equipment tray or drawer. Before attaching the leads to the tape, sort them according to degree of hardness and then write the hardness number on the tape.

Harry L. Spooner, Peoria, Ill.

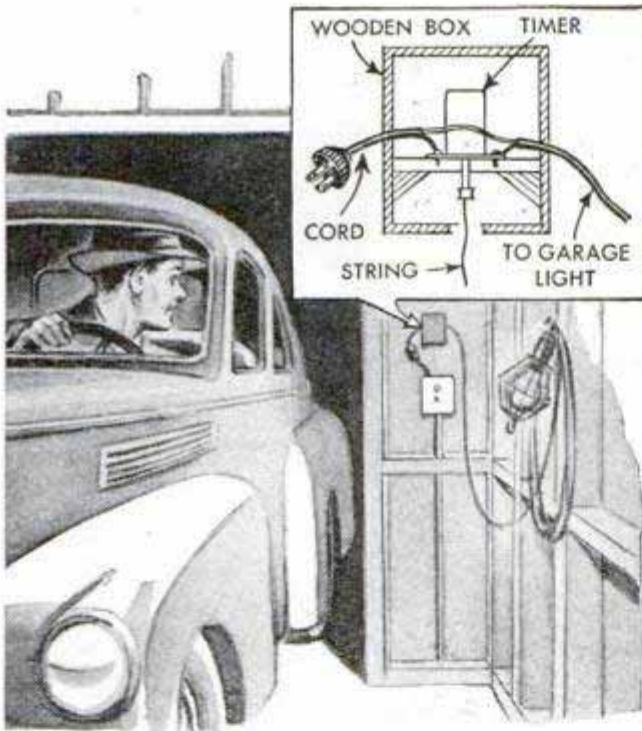


Demountable Lugs Fit Rubber-Tired Garden Tractors

Ideal for use on garden tractors and lightweight farm machinery, these demountable rims with attached lugs are slipped over rubber-tired wheels to provide traction in mud or snow. The rim is a length of flat iron bent to fit closely around the periphery of the wheel when the tire is fully inflated. For lugs, short lengths of $\frac{3}{8}$ -in. flat iron are welded on edge to the rim and at an angle as shown, so they will "bite" into the mud. Then two crosspieces are tack-welded to fit across the outside of the wheel. Four short pieces are bent to form quarter circles, and are bolted in



place where the crosspieces join the rim. These clamp against the inside surface of the tire. It will be necessary to deflate the tires when mounting the rims and then inflate them when the rims are in place.



Time Switch Extinguishes Light After Backing From Garage

Especially handy in rainy weather, this time-switch device, when wired as shown in the detail, will turn off a garage light at a predetermined time and thereby make it unnecessary to get out of the car after backing from the garage. The switch consists of a timer of the type used on model-airplane engines, which can be set from 30 seconds to 3 minutes. Install the timer in a wooden box as shown, letting the pull cord from the timer extend out through a hole in the bottom.—Stuart E. Anderson, Grand Rapids, Mich.

Grease Drum Kept in Garbage Can

A garbage can of the type having a pedal-operated lid is an ideal container for a grease drum. Ordinarily, after the lid is removed from the drum, it is not replaced and the grease collects dust and dirt. When the lubricant is used, this dirt may find its way into the lubricating system of the car or other machine that is being greased and, in time, damage bearings or other parts. In addition to keeping the grease clean, the covered container also reduces fire hazard and gives the shop a neater appearance.



INSTALLING CAR SPRINGS

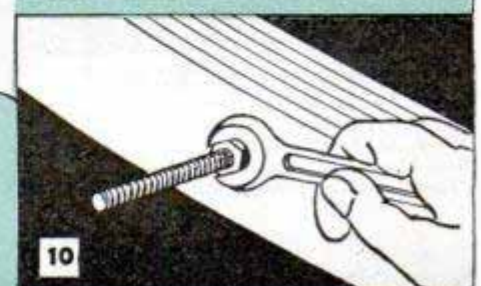
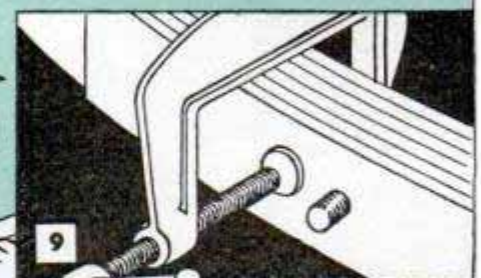
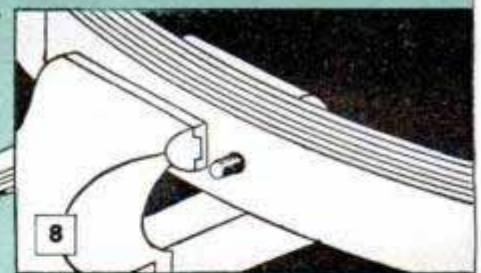
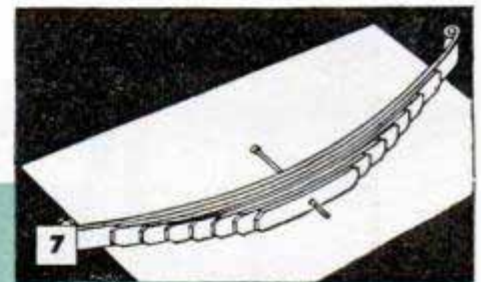
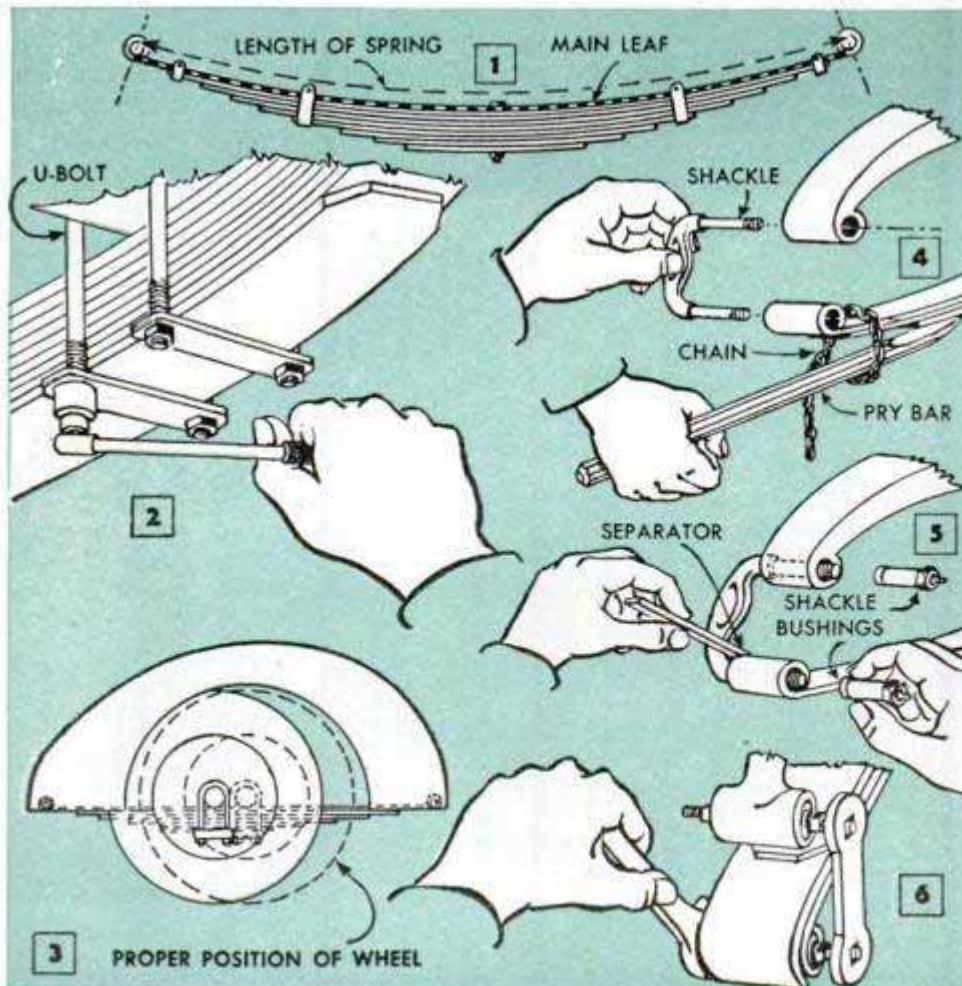
ALTHOUGH repairing or replacing a broken or damaged spring is a simple job, waiting for your turn to have it repaired may take several days. Rather than have your car or light truck out of service for this length of time, why not install the spring yourself? Figs. 2 to 6 inclusive detail the usual procedure in removing a spring. If the spring is to be replaced, or if it is necessary to replace the main leaf, it's important to know the exact length. Fig. 1 shows how to measure it correctly. Before loosening any of the parts or jacking up the car, block both the front and rear wheels securely. Use a roll-away jack if the work is done on a level floor. Assuming that a rear spring is to be removed, place the jack against the frame about 6 in. ahead of the spring. Raise the car until the spring assumes the normal "free" arch when tension due to weight of the car is removed. Wheels should not leave the floor. Block up under the frame at a point near the jack. Disconnect the shock absorber if it interferes. Then remove the U-bolts, Fig. 2, and the front and rear shackle pins to free the



eyes of the spring. On some late-model cars, such as Nash and Hudson, the emergency-brake cable is clipped onto the spring. In this case it will be necessary to cut the

clip bolt and replace it with a new one when the spring is installed.

Installing a spring after servicing or repairing it is just as easy as the removal if the correct procedure is followed. Figs. 7 to 10 inclusive detail the first steps. Arrange the spring leaves on a table according to size and length. If the center holes of the leaves are not equally distant from the ends, be sure before installing the center bolt that the long ends face the same way. Align the leaves with a straight pin or rod of the same diameter as the bolt, Fig. 7. Don't attempt to draw up the loose leaves with the center bolt; you are very likely to strip the threads. With the pin in place, tighten the spring in a heavy vise as in Fig. 8, or with C-clamps as in Fig. 9. Remove the pin and install the



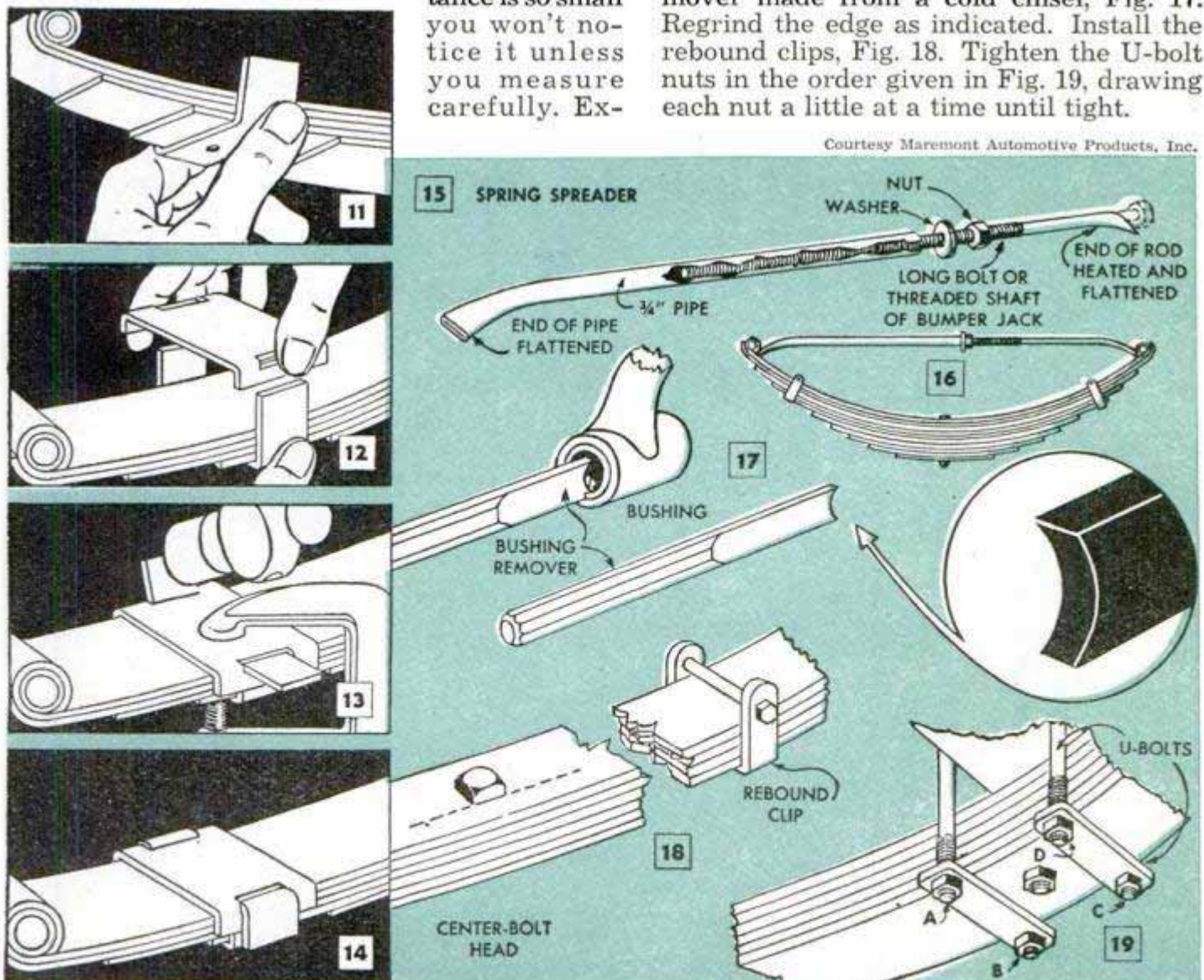
bolt as in Fig. 10. On overslung springs, the head of the center bolt should be on the short-plate side of the spring, but on underslung springs the head of the bolt should bear on the main leaf. Any projection of a new bolt beyond the nut after tightening, Fig. 10, should be cut off. Align the center-bolt head as in Fig. 18. The spring clips may now be installed, Figs. 11 to 14 inclusive. Place the U portion of the clip in proper position, with the nib fitting into the rivet hole. Apply the saddle so that the ends of the lower plate extend through the upper openings. Hammer down both ends firmly. Remove the clamps and the job is done.

When placing the spring back in position, be sure that you have it "right end to" so the car or truck axle will be in the correct position, Fig. 3. If the center bolt is in the center of the spring, and the eyes or bushings are the same at both ends, then there's nothing to worry about. But one must watch for springs with different eyes or bushings which must be matched with the shackles, to get the right end forward. Also some springs are made with the center bolt off-center. Sometimes this off-center distance is so small you won't notice it unless you measure carefully. Ex-

cept in a few instances, the short end of such a spring is always installed toward the front. Generally, the swinging shackle has ample freedom of movement so that assembly is easy. But for cars with U-shackles a separator must be used to keep the eye of the spring in position, Fig. 5. Also, it sometimes is necessary to place a jack under the spring near the center bolt and spread or flatten the spring sufficiently to bring the eye within reach of the shackle. Then with a pry bar and chain arranged as in Fig. 4 the spring can be brought into position so that the shackle will slip in place. If shackles are of the type shown in Fig. 6, place the shackle link on the stud of the perch bushing and line up with the spring-bushing stud. With a wrench turn the spring stud so that the opening in the link will fit over the squared section of the stud. Then turn on the nuts, tighten, and install cotter pins.

On Ford, Lincoln and Studebaker cars it is necessary to use a spring spreader made from a length of pipe and a threaded rod as in Fig. 16. When removing worn or defective perch bushings on Ford, Mercury and Lincoln cars use a bushing remover made from a cold chisel, Fig. 17. Regrind the edge as indicated. Install the rebound clips, Fig. 18. Tighten the U-bolt nuts in the order given in Fig. 19, drawing each nut a little at a time until tight.

Courtesy Maremont Automotive Products, Inc.



Tire-Casing Headrest on Creeper Contains Wiping Cloths

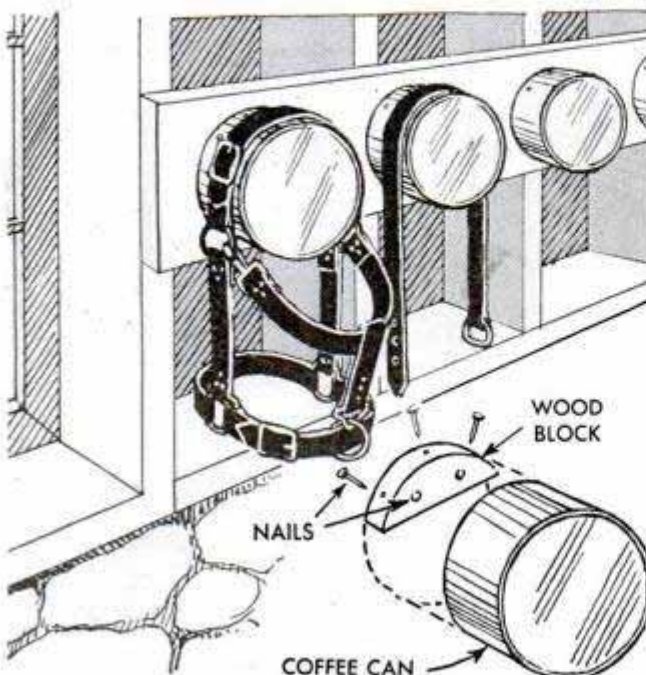


SECTION OF TIRE CASING

With a section cut from a tire casing, you can make a headrest for an auto creeper that also will provide storage space for wiping cloths. Spread the casing and fasten it to the creeper by means of nails driven through the bead. When stored inside the headrest, cloths are easy to get at and there is room for a good supply.

Coffee-Can Rack Holds Harness

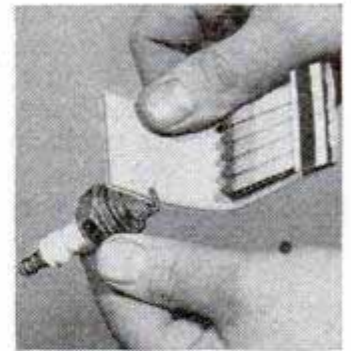
Cut in half and mounted on a board, discarded coffee cans make handy harness racks. Unlike pegs or nails, they will not cause kinks in leather straps. To make the rack, nail a board to the barn studding and then nail on semicircular wood blocks that will fit inside the bottom half of a 1-lb. can



of the vacuum-sealed type. After the cans are nailed to the blocks, paint them white so they can be seen easily.

Match Book Checks Spark Plugs

If you ever find it necessary to set the electrodes on a spark plug and have no gauge at hand, an emergency setting may be obtained by using a paper match book as a gauge. The paper used in these books is approximately .020 in. thick, while most spark-plug settings are about .025 in. Therefore, if the electrodes are adjusted so that one side of the book will slide between them with a very slight drag, you will have a plug setting that will do until it can be adjusted with a gauge.



H. Leeper, Canton, Ohio.

Fitting Head Gasket to Save Wear

When replacing the cylinder-head gasket on an auto engine, fit the smooth side against the block and the side that has a rim running around the edges should be next to the cylinder head. Also, when a head is removed for an overhaul or for a blown gasket, look for wearing and grooving. If excessive, plane the head with a special grinder made for that purpose so the gasket will be a good fit.

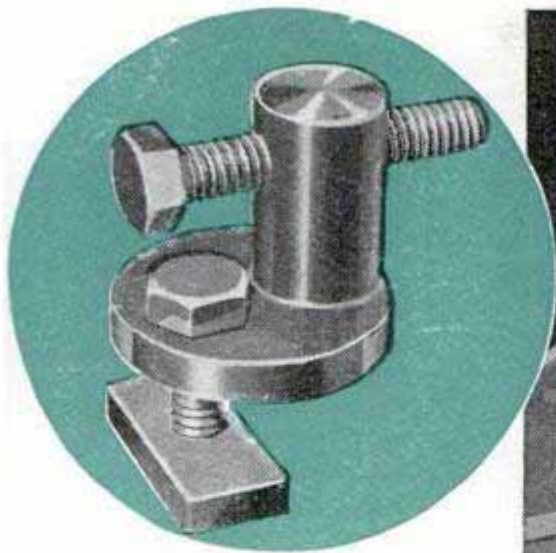
D. W. Brentlinger, Richmond, Calif.

Ball Stop for Vise Handle Speeds Clamping

Opening and closing a machinist's vise repeatedly in clamping duplicate parts, is done more rapidly if the vise handle is centered in the vise-screw hub. The detail shows how this is done. Simply insert a steel ball and a small compression spring into a hole drilled and tapped in the screw hub of the vise. These parts are held in place with a socket setscrew. The steel ball engages a concave groove filed in the vise handle around the center. The spring should exert sufficient pressure to hold the ball in the groove and yet allow the handle to slide.

Nathan Bogoch, Winnipeg, Man., Can.



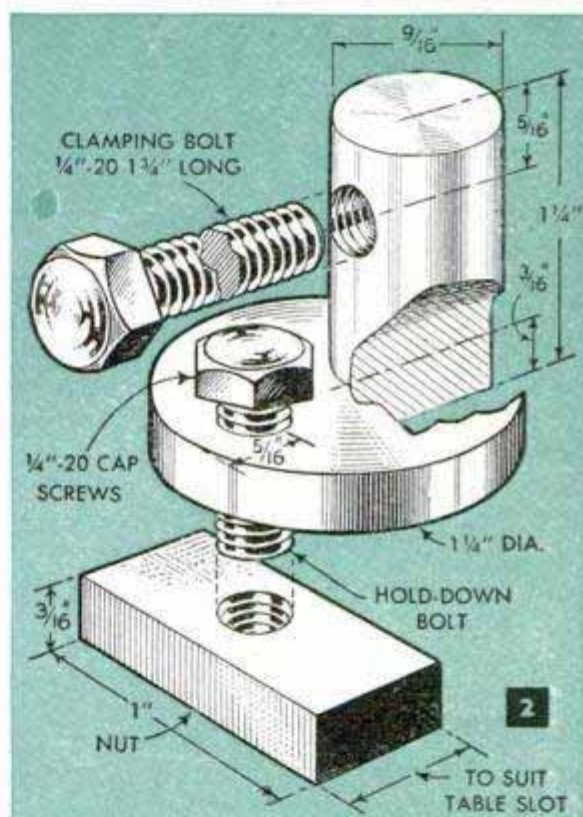
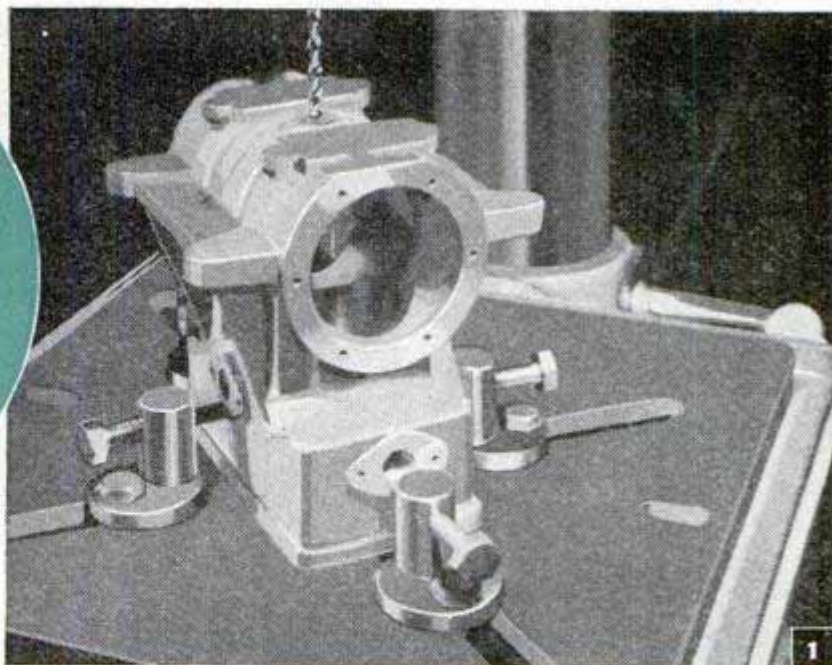


Quick-on

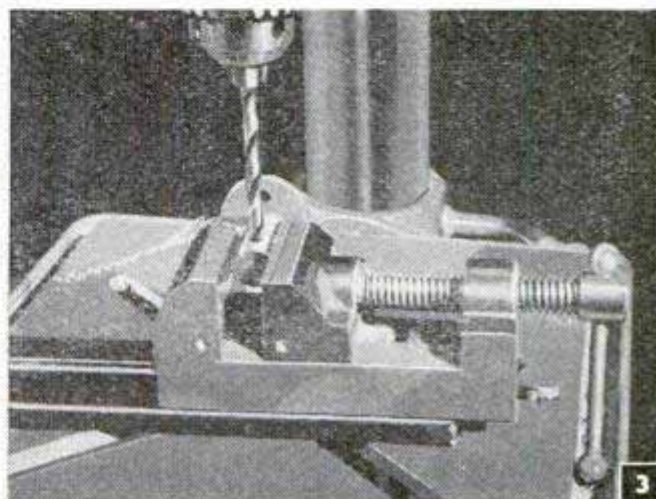
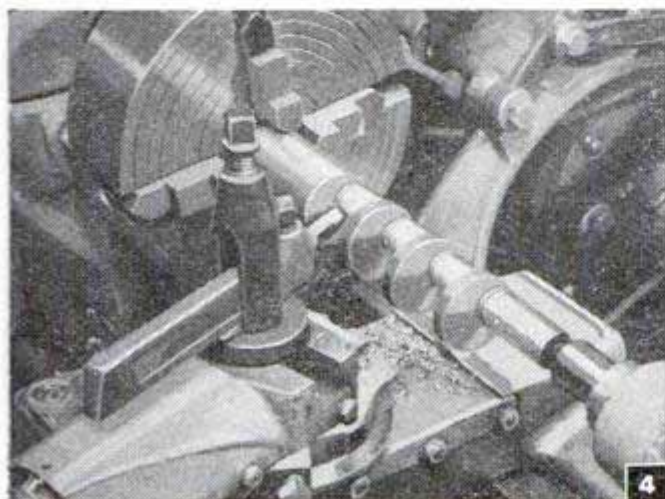
DRILL-PRESS CLAMPS

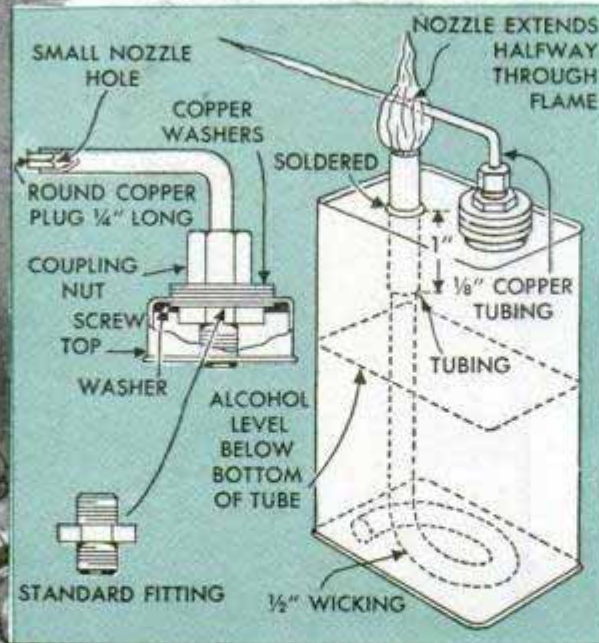
By Will Thomas

These clamps are so designed that they drop into the slots in the drill-press table and can be tightened in a jiffy. They are especially handy when doing close work because it's never necessary to remove nuts and washers from bolts that project under the table. As you see in Fig. 1, the individual clamps can be set in various positions to hold work which is irregular in shape. Fig. 2 details one unit, and you can make as many as you need by simply duplicating parts and operations. To make duplicate clamps, chuck 1½-in. round cold-rolled stock off-center as in Fig. 4, carrying the outer end of the piece on the tail center. Turn to the dimensions given in Fig. 2 and you have four cam shapes as in Fig. 4. Saw these apart, then drill and tap for the clamping bolts, Fig. 3. The rectangular-shaped nuts, Fig. 2, are cut from ¾-in. flat steel and finished by filing. Be sure that the nuts slip through the table slots. Drill and tap nuts exactly in the center so that strain is equalized when the bolts are tightened.



Clamps also can be used on a milling machine or lathe faceplate to hold irregular-shaped work



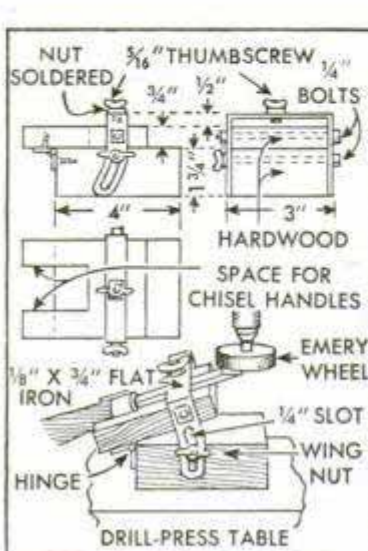
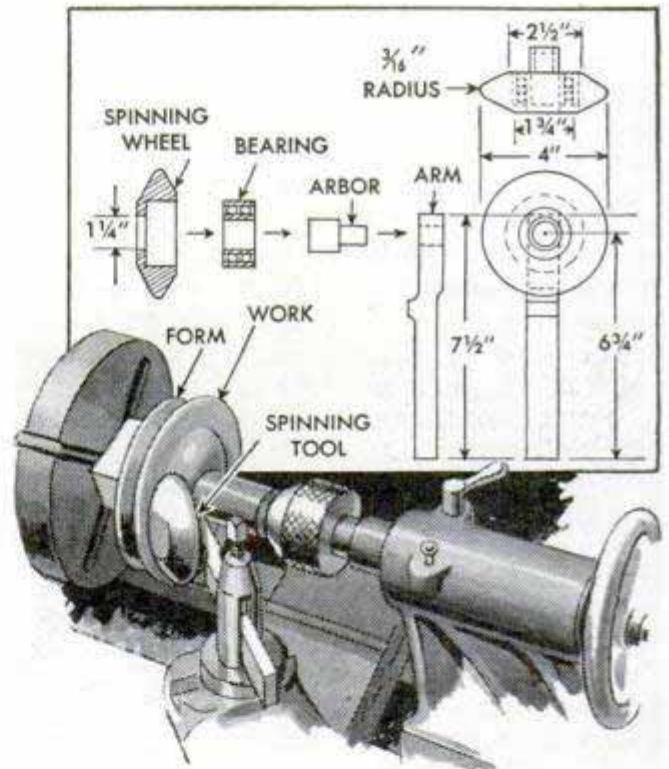


Alcohol Torch Made From Scrap Parts

Producing a hot, needle-point flame, this little blowtorch, which generates pressure by the expansion of alcohol vapor, will be found handy for many small soldering and light brazing jobs. The tank is a lighter-fluid can, and the nozzle, consisting of a length of $\frac{1}{8}$ -in. seamless tubing, is attached to the screw-top cap of the tank as shown. The wick is fed through a $\frac{1}{2}$ -in. tube which is soldered in the top of the can to extend 1 in. inside. Note that the hole in the nozzle must be very small.

Nonfriction Spinning Tool

Designed to spin with the work, this ball-bearing spinning tool offers several worthwhile advantages; it eliminates tool marks, keeps friction heat at a minimum and produces a finer finish on the metal being spun. The tool is used in conjunction with the compound rest of a metal-turning lathe and is manipulated by the cross and carriage feeds of the lathe. All parts of the tool are dimensioned in the drawing. It may be necessary to alter the size of the arm to suit the tool post at hand, and also the size of the wheel to fit the bearing. The wheel should be case-hardened, and the arbor a light press fit in both arm and bearing. Peening the ends of the arbor locks the wheel to the arm. In using the tool, it is advisable to coat the work with a lubricant such as lard oil, to reduce friction and produce a smooth job.



Adjustable Jig Positions Chisel For Grinding in Drill Press

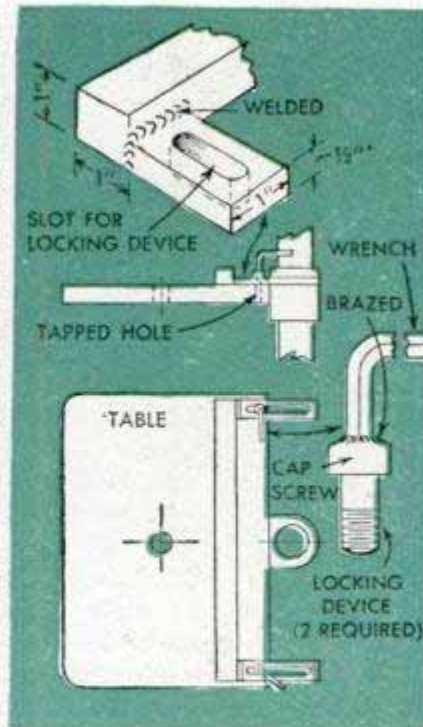
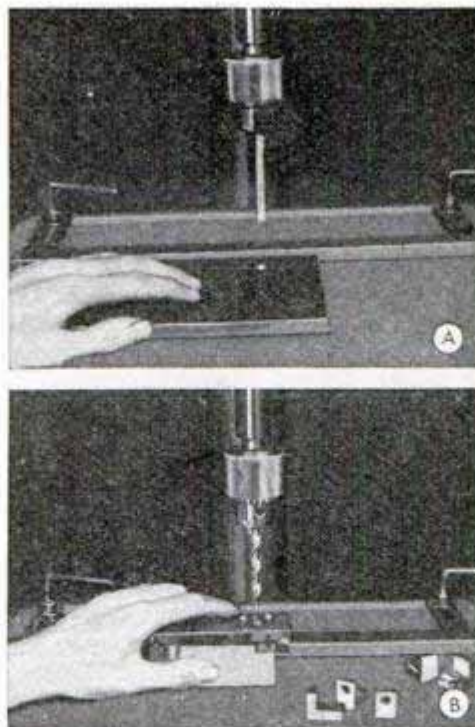
With this jig, chisels, plane irons and other flat-bladed tools are held at the correct angle for sharpening in a drill press. The tilting top and base are cut as shown in the detail, the top being notched for chisel handles. Angle adjustment is provided by a metal strap bolted to the top and slotted for bolts and wing nuts in the base. Space is left between the strap and the tilting top to allow for insertion of the tool blade. A thumbscrew holds the tool.

Gust M. Larson, Cloquet, Minn.

Adjustable Fence For Drill Press

This drill-press fence can be used either to position flat pieces for drilling, detail A, or as a rigid support to which work can be clamped as in detail B. When not in use, the holder can be removed from the table or slid back out of the way. Assembly is shown in the right-hand detail. A slotted arm is welded to each end of the fence, which extends almost the width of the table. Holes are drilled and tapped in the drill-press table for two locking or adjusting screws. The latter consist of socket-headed cap screws with socket-type wrenches brazed in the heads of the screws. Besides being useful for drilling jobs, such a fence will be found handy for routing and shaping.

Edmund L. Johnson, Pittsburgh, Pa.

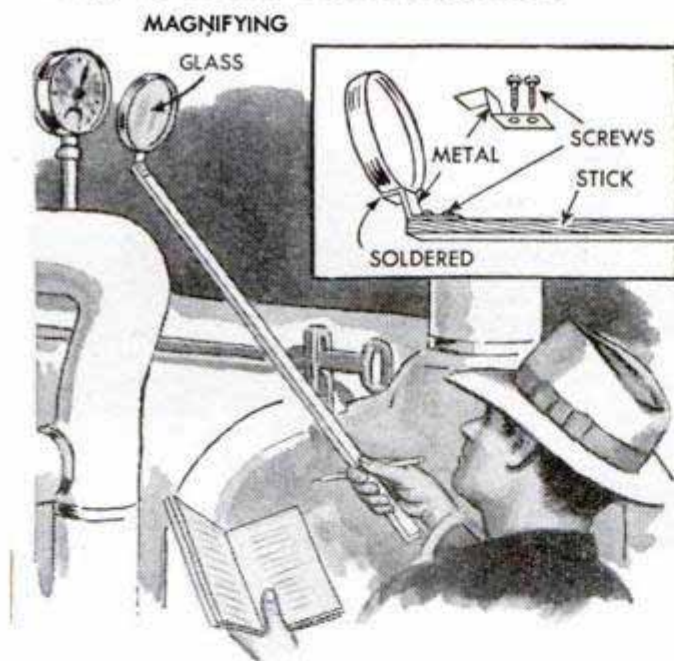


Bulletin Posted At a Filling Station Gives Motorists Weather Forecast

Salesmen, tourists and others driving through unfamiliar territory will appreciate the weather-bulletin service offered by one filling-station operator. The information, which includes road conditions as well as the weather, is posted on a blackboard suspended over the driveways near the gas pumps. The board slides on a wire between the station and a post, being high enough to clear the cars that pass under it. The sign is changed by sliding it over to a building or post so it will be accessible. Information about the weather can be obtained from the local weather bureau or over the radio.



Pressure Gauge on Heating Boiler Easy to Read With Magnifier



Usually the pressure gauge and other indicating instruments on a heating or power boiler are located on top of the unit, often in a dimly lighted spot, where they are difficult to read. To overcome this disadvantage, use a reading glass attached to a long handle so the glass can be held in front of the gauge. The rim of the glass is soldered to an offset metal clip, which in turn is screwed to the handle.

STRONG CABINET JOINTS

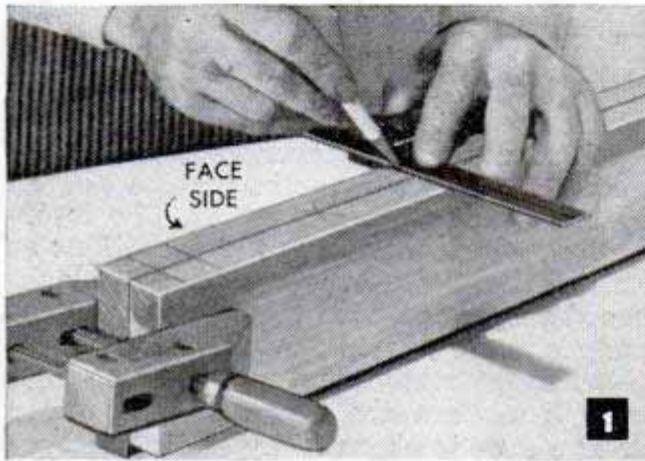
FOR MOST types of joinery, a good dowel joint is adequate. It can be made quickly and compares favorably in strength with mortise-and-tenon joints. It's the ideal joint for toys and light furniture construction.

Edge joints: Joining boards edge to edge is a common application of the dowel joint. The preferred method of working calls for clamping the boards together, face sides out, as in Fig. 1, and ruling crosslines to indicate the dowel position. A spacing of 8 to 10 in. between dowels is recommended, with two dowels at each end, Fig. 3. All drilling of holes is done with the face side of the work against a fence mounted on the drill-press table, as shown in Fig. 2. This automatically sets the crosswise spacing

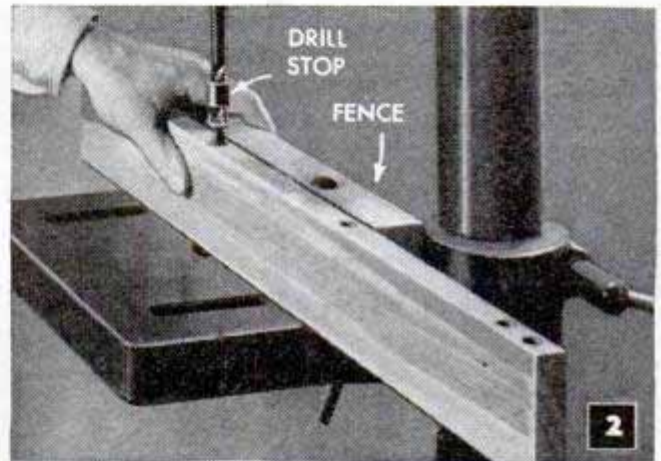
By Sam Brown

and makes all dowel holes a uniform distance from the face surface. The fence itself should be short and of sufficient thickness to assure accurate alignment parallel with the drill.

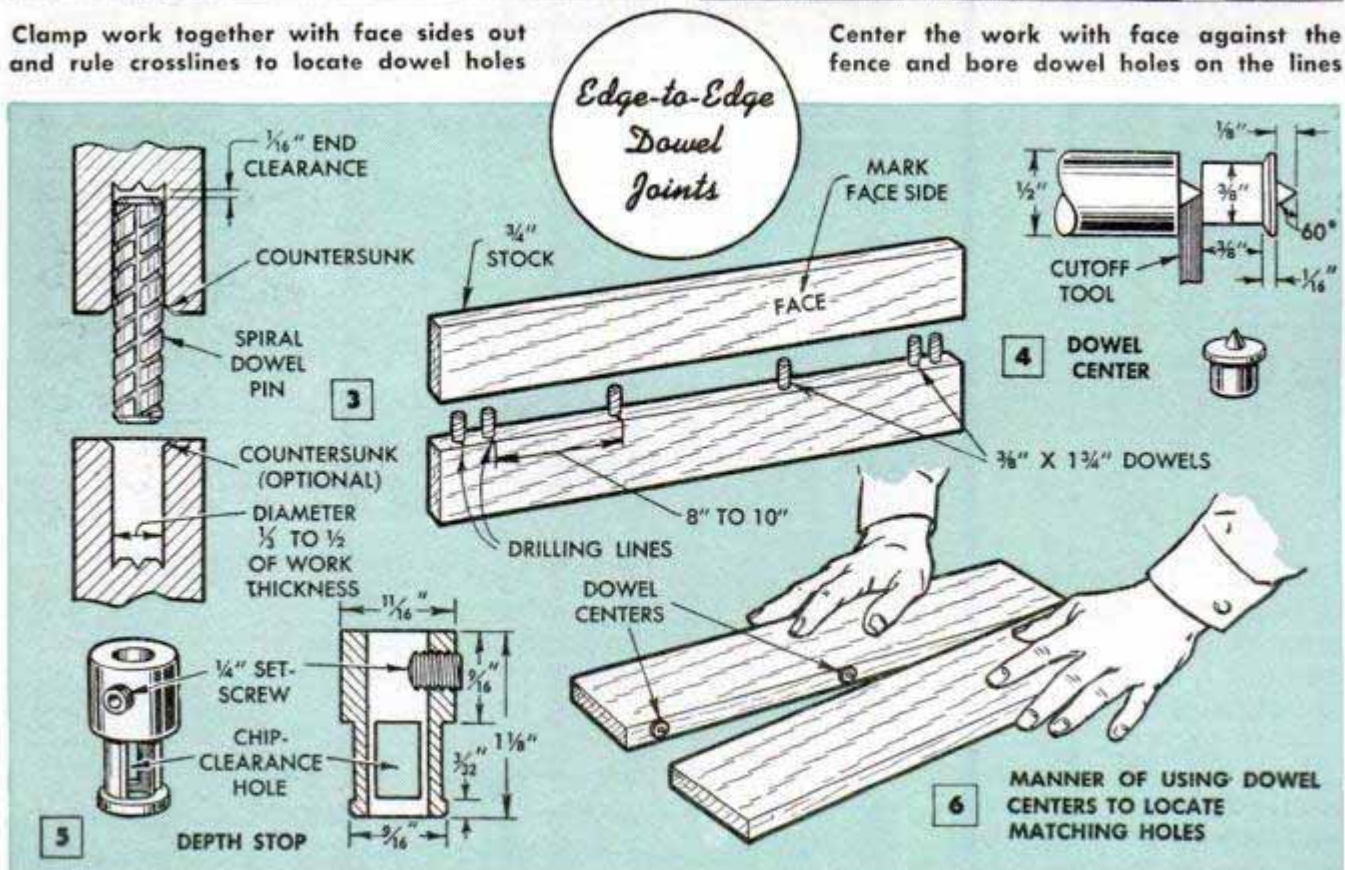
In a second method of working, no pencil guide marks are used, and the work is simply held against the fence while the holes are spaced by eye. Dowel centers, or pops, are inserted in the holes, and then, by contacting the two boards face downward, Fig. 6, registering marks are transferred to the second board. Dowel centers can be purchased, or they can be turned from cold-rolled steel to the shape shown in Fig. 4. If drilling is done by hand, both methods described require a stop on the drill bit to set the depth. This can be



Clamp work together with face sides out and rule crosslines to locate dowel holes



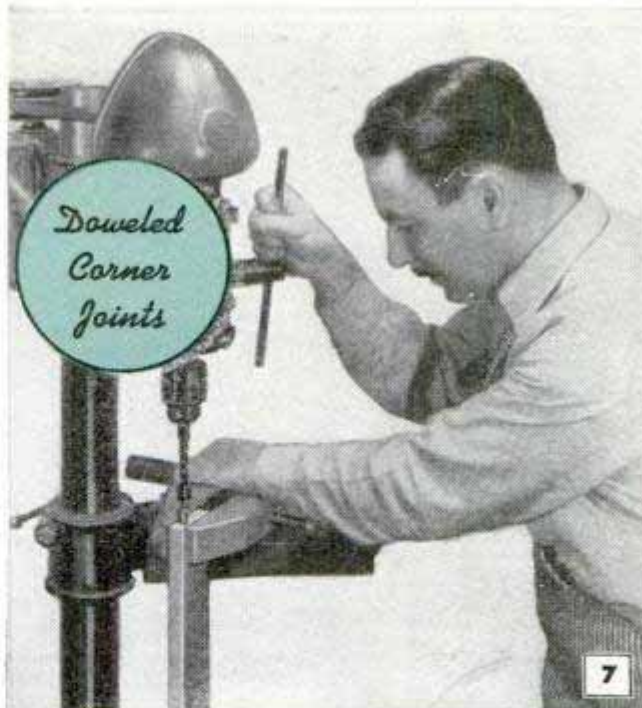
Center the work with face against the fence and bore dowel holes on the lines



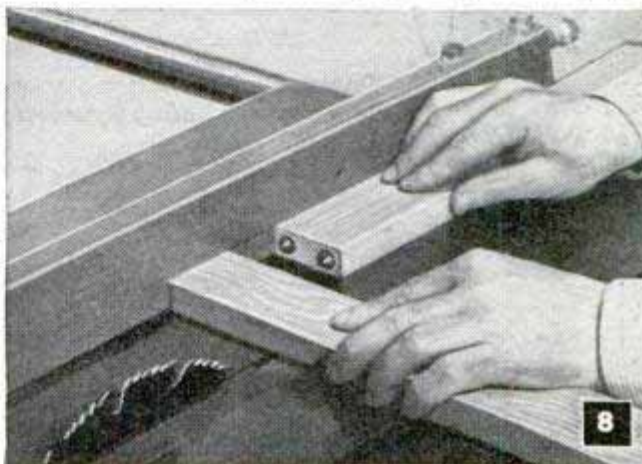
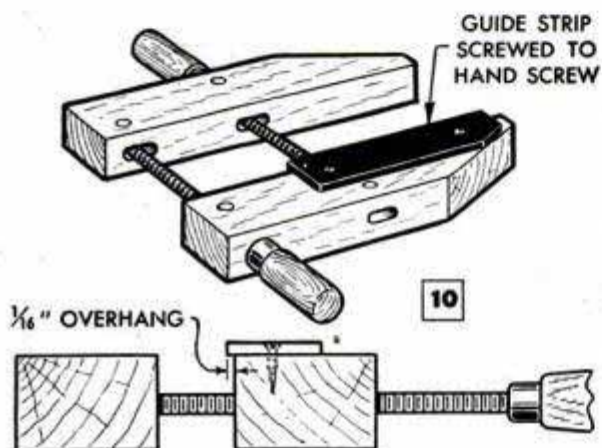
with DOWELS

made as shown in Fig. 5, or a short dowel can be drilled lengthwise and slipped over the bit. As most joints are made with $\frac{3}{8}$ -in. dowels, one size of stop will do. Occasional work requiring smaller or larger dowels can be drilled for depth by fastening adhesive tape around the bit.

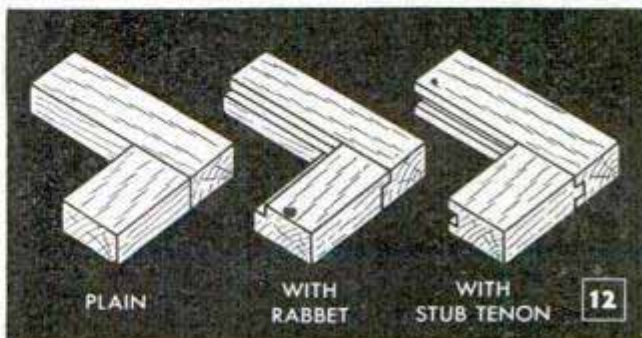
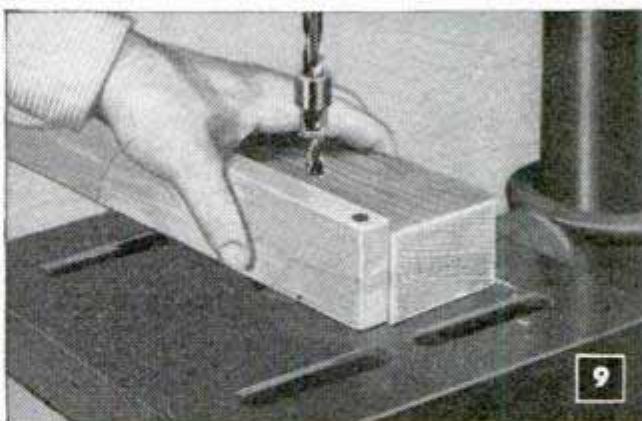
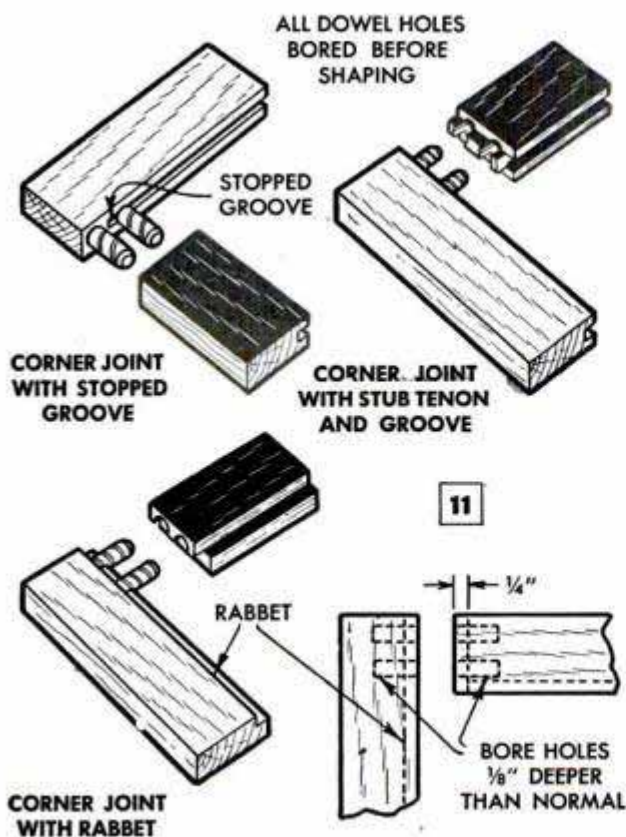
Corner joints: This is the most used dowel joint. The best method of making it is to drill the end-grain holes first, Fig. 7, spacing them by eye, and then use dowel centers for locating the side holes in the second piece, as shown in Fig. 8. A fixed fence is not used for drilling the side holes, but it is advisable to use a backing block or floating fence, Fig. 9, to keep the work square with the table. The difficult part about this joint is drilling the holes in the

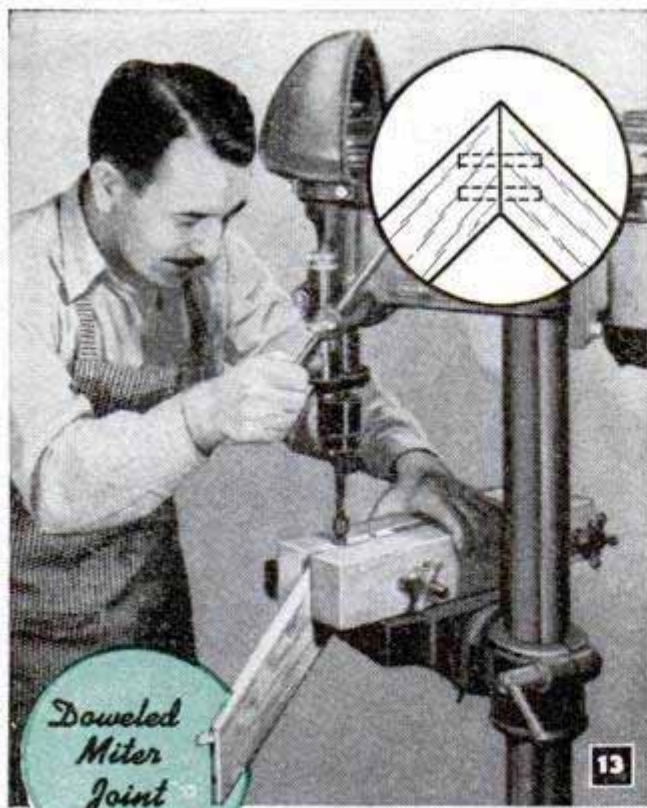


Bore holes in end grain first, spacing them by eye



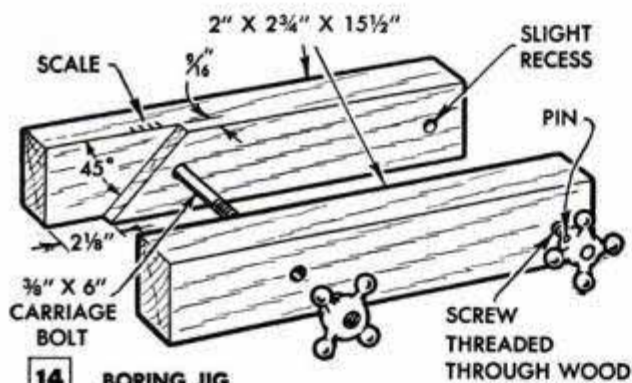
Above, locate position of side holes with dowel centers. Below, drill side holes with work against block





Doweled Miter Joint

Doweled miter joints are easy to make with boring jig below



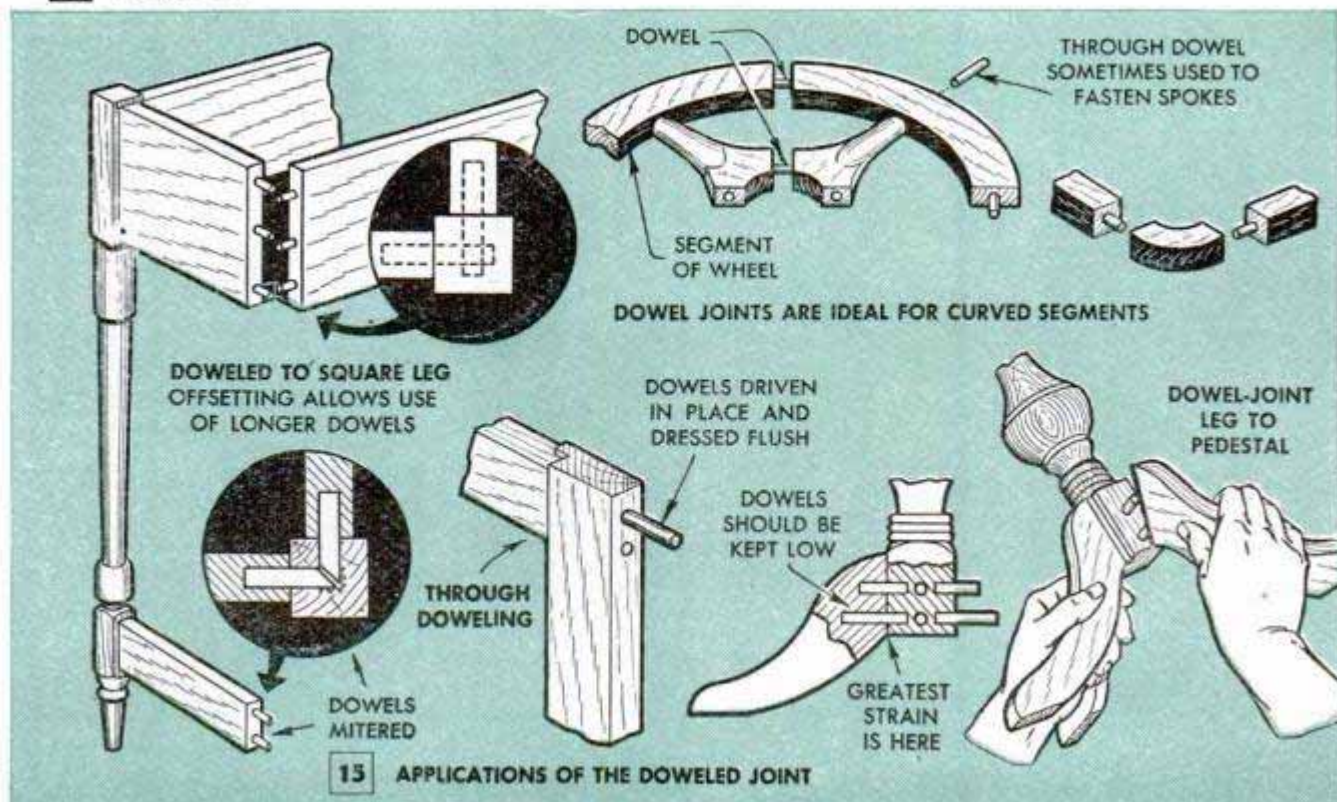
14 BORING JIG

end grain of the first piece. However, this is made easy with a handscrew fitted with a stop, as shown in Figs. 7 and 10. In use, the work is aligned with the bit by clamping it in the handscrew so that the end butts squarely against the stop attached to the jaw. Then the table is swung to one side to support the handscrew. Note that the table must be at right angles to the bit.

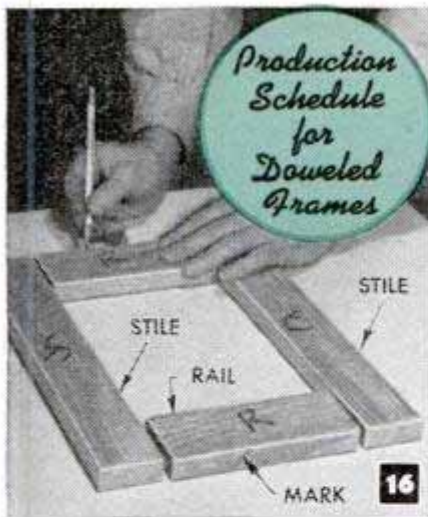
Various forms of the corner joint are shown in Figs. 11 and 12. Where the work is to be grooved or rabbeted, dowel holes should be drilled first. The stub tenon and rabbeted frames, Fig. 11, will lose $\frac{1}{4}$ in. at the joint when shaped, and this should be allowed for. Make rails $\frac{1}{2}$ in. longer than normal, and drill dowel holes $\frac{1}{8}$ in. deeper.

Doweled miter joint: Dowel holes are always bored at right angles to the contacting surfaces which are to be joined. This is fairly obvious in the 45-deg. miter joint, Fig. 13. Working with the handscrew setup, or with the somewhat similar boring jig shown in Fig. 14, the contacting surface of any joint is presented squarely to the drill. The method of making a miter joint is the same as a corner joint—eyespaces the first piece and then use dowel centers to locate holes in the second piece.

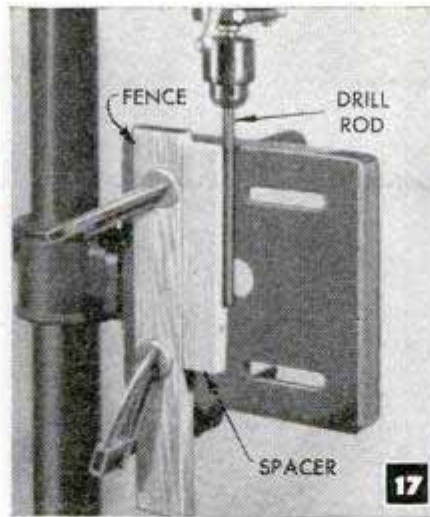
Various applications: While there are many uses for the dowel joint, all dowel joinery follows the same pattern, that is, two butting surfaces joined together with dowel pins. Typical work is shown in Fig. 15. For all occasional work, the dowel-center method of locating holes is used, and holes in end grain are drilled first, because it is difficult to mark accurately and spot a drill on this kind of surface.



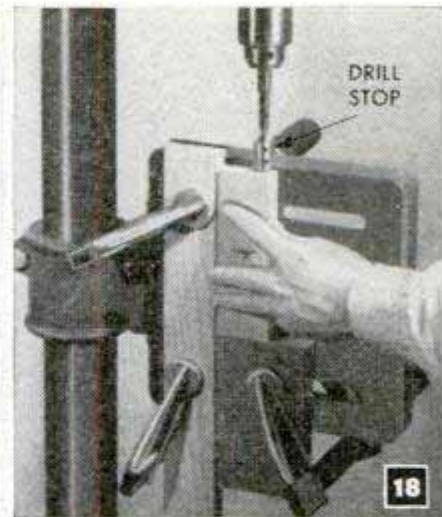
15 APPLICATIONS OF THE DOWELED JOINT



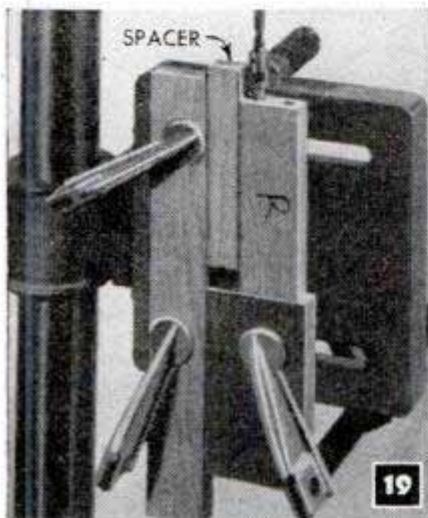
First, make rough assembly of frame, mark face side and outer edge of all members with pencil



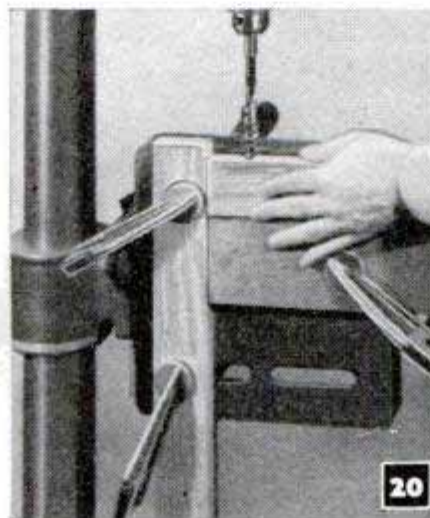
Next, with drill-press table tilted vertically, insert drill rod in chuck and align fence with rod



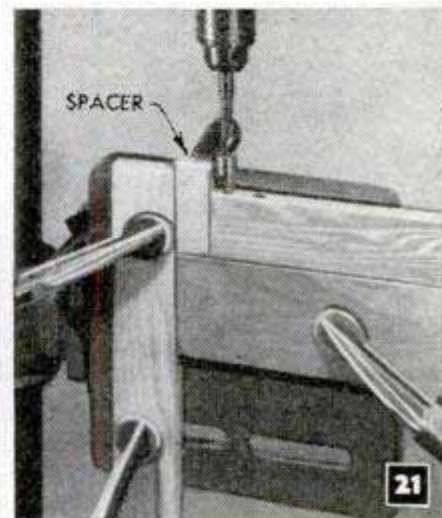
Drill the end holes in all rails first, placing the marked edges against a fence clamped to table



Drill second hole in end of rails by using same setup plus wooden spacer to space holes desired width



With work positioned by vertical fence plus horizontal rest, drill first end holes in stiles of frame



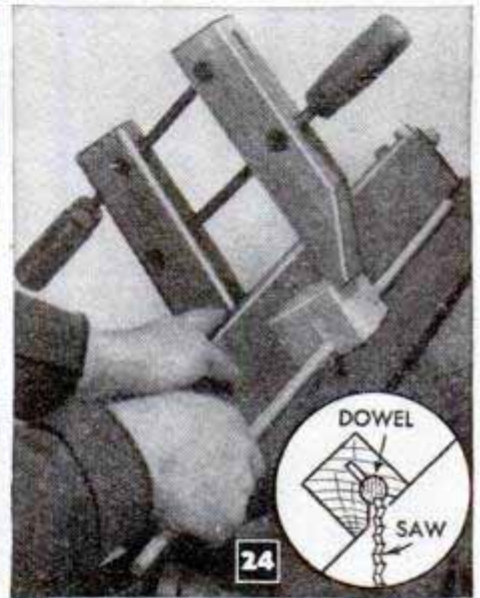
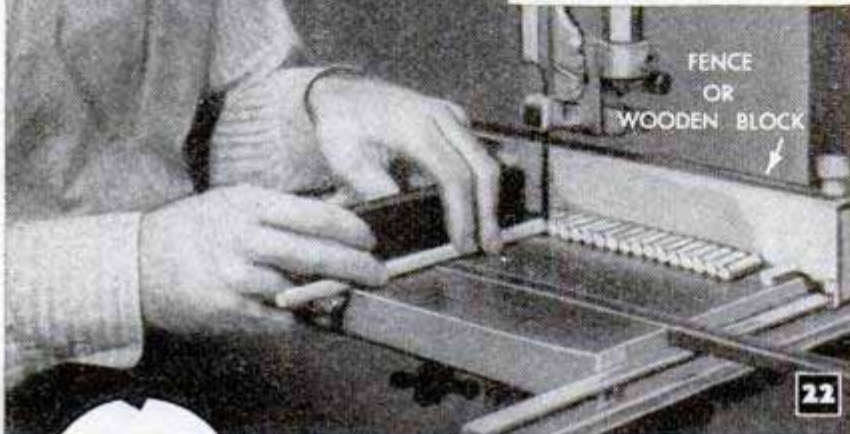
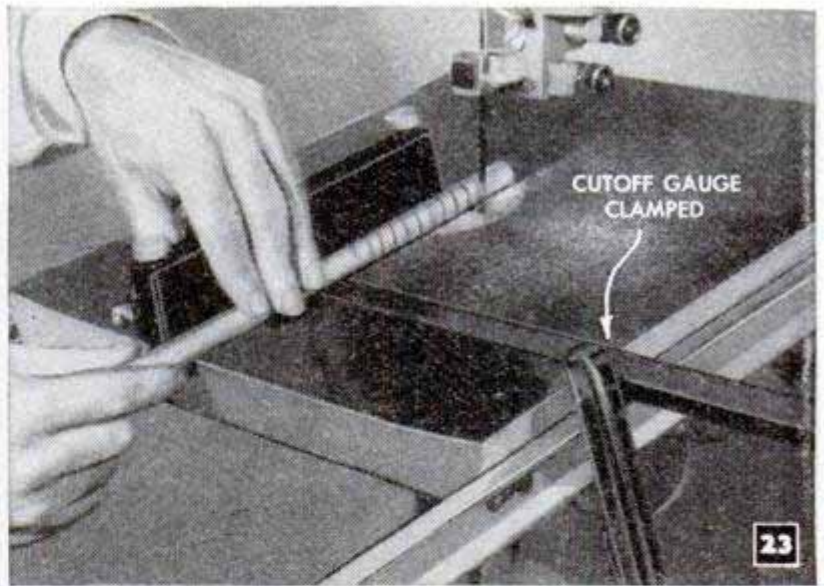
As in drilling second dowel hole in ends of rails, repeat same operation, using short spacer block

Production work: Dowel centers are too slow for production work, and various methods employing box jigs or spacers give better results. The schedule for a doweled frame is pictured in Figs. 16 to 21 inclusive. In this setup, one stop is clamped to the drill-press table, and this stop is used for both parts of the joint, giving perfect accuracy in the lengthwise spacing. As each joint consists of a right and left-hand member, the face side will alternately face toward and away from the fence. This makes it essential that, (1) the work be of uniform thickness, and (2) the drill must be exactly centered crosswise.

The dowel drill: The best type of drill for dowel work is the popular twist-drill pattern with spurs and brad point. The point should run true so that when rotating, it will seem to stand still and can be centered with hairline accuracy. Drill speed should be 1200 r.p.m. for hardwoods and 2400 r.p.m. for softwoods. Extension spurs on the drill should be short and

sharp to eliminate leading or wandering tendency when drilling end grain.

The dowel pin: The dowel pin itself is usually birch or maple and is purchased ready made. Specify a spiral, grooved pattern, which has the best holding power. The diameter of the pin should be one third to one half the thickness of the work—never less than one third. As a large percentage of all work is $\frac{3}{4}$ -in. stock, the $\frac{3}{8}$ -in. dowel is the size most used. The length should be five or six diameters for average work. Thus, a $\frac{3}{8}$ -in. dowel should be $1\frac{3}{4}$ or 2 in. long, and either of these stock sizes can be used for most jobs. When smaller or larger diameters are needed in small quantities, the dowel pins can be made from standard dowel rod. Cutting-off to length is done on the bandsaw, Fig. 22. If a spiral groove is desired, it can be cut very neatly by tilting the bandsaw table 15 or 20 deg., and then pushing the rod into the blade against a clamped fence, as shown in Fig. 23. The dowel rod will feed



Dowel Pins

Dowel pins may be purchased, but odd sizes can be turned in short lengths on lathe. The photos show way of mass-cutting pins to length and spiraling on bandsaw. The glue groove, running lengthwise, is produced on bench saw

itself and requires only a slight hold-back hand pressure to prevent over-running. While the spiral groove is not essential, some kind of grooving should always be used to provide an outlet for excess glue. The straight groove is easily run with the saw setup shown in Fig. 24.

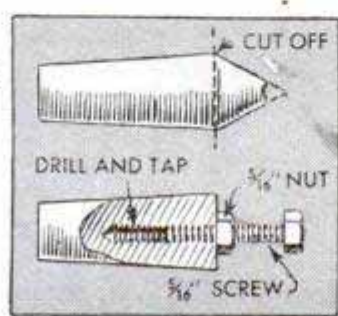
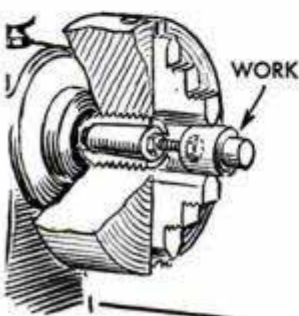
Gluing: Any cabinet glue, hot or cold, is satisfactory for doweled joints. A small dowel is used to put glue into the hole, and the dowel itself is dipped half its length

into the glue. If the joint is not to be assembled immediately, any excess glue should be wiped off. If the joint is to be assembled immediately, the small dowel stick is used to spread glue in the second hole and over the projecting part of the dowel. Then, the joint is pressed together and clamped. Slight countersinking of dowel holes, as shown to the left of Fig. 3, is a good idea and is intended to provide a recess for excess glue.

Depth Stop for Engine-Lathe Chuck Made From Tailstock Center

Work being turned on an engine lathe frequently will push back into the chuck. To eliminate this trouble, make a depth

stop from an old tailstock center. The point of the center is cut off as shown. Then the center is drilled and tapped to take a $\frac{5}{16}$ -in. machine screw. The screw is inserted in the center, and a nut is used to lock it in position. After adjusting the screw so that the work rests firmly against the head, place the assembly in the lathe chuck.



☞ To remove transfers from walls, lay a wet cloth over them and then apply heat with an electric iron. After the transfers are softened, they are scraped off.



EIGHT-TUBE HIGH-FIDELITY FM TUNER AND SPECIAL-PURPOSE AMPLIFIERS

LISTENING thrills that come when you hear music of your choice produced with full-scale fidelity, free from static, station interference and fading are now possible under all conditions if the equipment is selected to meet the requirements.

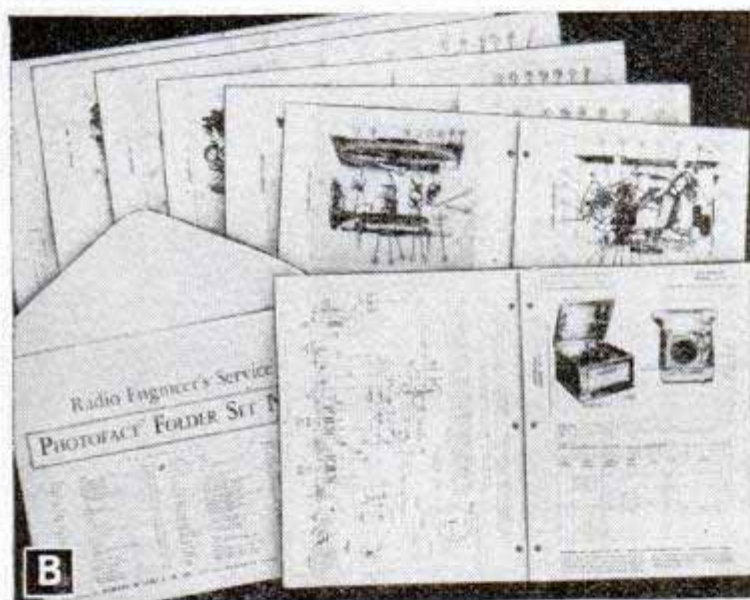
The quality of FM reproduction obtained through the audio stages of a good AM radio receiver is very satisfactory if a well-designed FM tuner having sufficient stages is employed. The 8-tube FM tuner shown in photos A and C tunes the entire new FM band from 88 to 108 megacycles and the audio fidelity is claimed to be flat within plus or minus 2 decibels from 50 to 15,000 cycles per second. The sensitivity of this FM tuner is rated at 40 microvolts, and the antenna input impedance is 300 ohms. When connected to a suitable dipole antenna with 300-ohm Amphenol twin-line, this Meissner FM tuner may be used with old AM-FM sets to provide full coverage of the new FM band.

For the critical FM listener any good phono amplifier such as the Thordarson Tru-Fidelity unit No. 1 in photos A and B is capable of fidelity in keeping with that attained with modern broadcast equipment. Type 6B4-G tubes are employed in the final output stage, and 10 watts of undistorted audio are available for the operation of a large permanent-magnet speaker which may be housed in an effective enclosure such as the Jensen "bass reflex" type shown or similar enclosures. Subject to rearrangement to meet individual requirements, this combination produces excellent results in the home, small hall or similar locations.

When selecting a larger audio amplifier for undistorted audio power in large indoor or outdoor areas, the output should be at least 25 watts. Amplifier No. 2, rear view of which is shown in photo D, is an efficient beam-power type that meets these requirements with only 7 tubes; two 6L6 tubes are employed in the push-pull output stage. Two or more large speakers are commonly used with powerful audio amplifiers of this description. Many other special-purpose applications are possible with this 25-watt high-fidelity audio amplifier. Provision is made for smoothly mixing two microphones with a phono input for a musical background.



Radio Data Service for All Postwar Receivers



DEVELOPED to assist the nation's radio servicemen who are responsible for keeping receivers in about 39,000,000 American homes in working order, this illustrated "Photofact" data service is claimed to provide complete and accurate information on all postwar commercial receivers. The photos are taken and data prepared immediately upon their release by the manufacturers.

The information is contained in individual folders, covering from four to eight pages for each receiver as shown in photo B. Each radio set is actually analyzed in the laboratory, which is located in Indianapolis, Ind., under realistic servicing conditions. One corner of this laboratory is shown in photo A. Here engineers are measuring the stage gain and over-all performance of various receivers under check. In specially constructed copper screened test booths the r.f. and i.f. coils are carefully checked and then the receiver is disassembled down to its very last component. The circuit is carefully studied and all necessary data for the serviceman is compiled from the actual electrical and mechanical measurements.

This service includes photos of the top, bottom and other necessary views of the chassis to illustrate each component part clearly. Every part is assigned a key number which appears on the photograph and these numbers serve as a cross-reference to the replacement parts listings, alignment data and service notes which appear in the folder. The draftsman in photo C is coding pictorial diagrams with these reference numbers. New war-developed techniques, such as "exploded" views that clearly explain complicated devices, are employed. In addition to commercial home receivers, the service covers other equipment such as amplifiers, intercommunication systems, automatic record changers and recording units.

Many important details such as dial-cord stringing, commonly overlooked by manufacturers, are sketched and marked for reference. Speakers, power transformers, audio transformers and chokes are checked and replacements for them are carefully worked out with the cooperation of the manufacturers.



KODASLIDE PROJECTOR, MODEL 2A, answers the demand for better-than-average performance at a budget price. The Kodak Ektanon Lens 5-inch $f/3.5$ is highly color-corrected . . . Lumenizing of the entire optical system increases screen brilliance 50% . . . special heat-absorbing glass protects transparencies from overheating. It all adds up to more for your money. Price \$47.50.

KODASLIDE PROJECTOR, MODEL 1A (see below) is a star performer in any show. The whole family will get a kick out of its big, bright 40-inch-wide images . . . its sharp focusing with the Kodak Ektanon Lens 4-inch $f/3.5$. . . its stepped-up screen sparkle through the completely Lumenized optical system. Socket in base provides handy mounting on tripod during projection. 150-watt lamp and slide carrier included. Price \$27.50.

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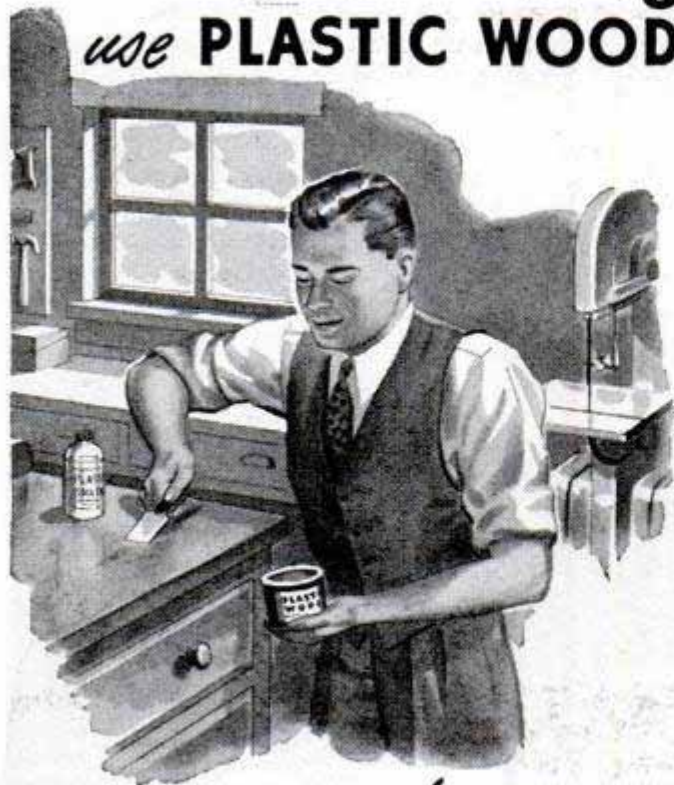
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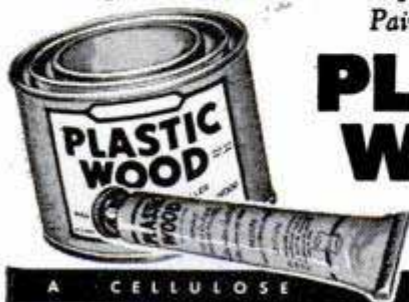
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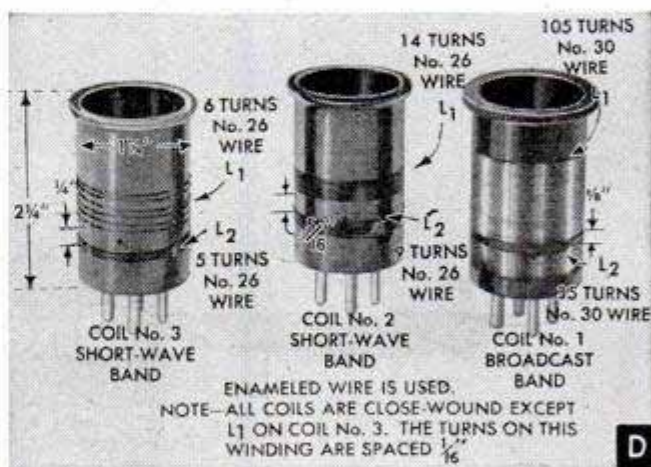
A CELLULOSE FIBRE FILLER

Low-Cost Progressive Receiver

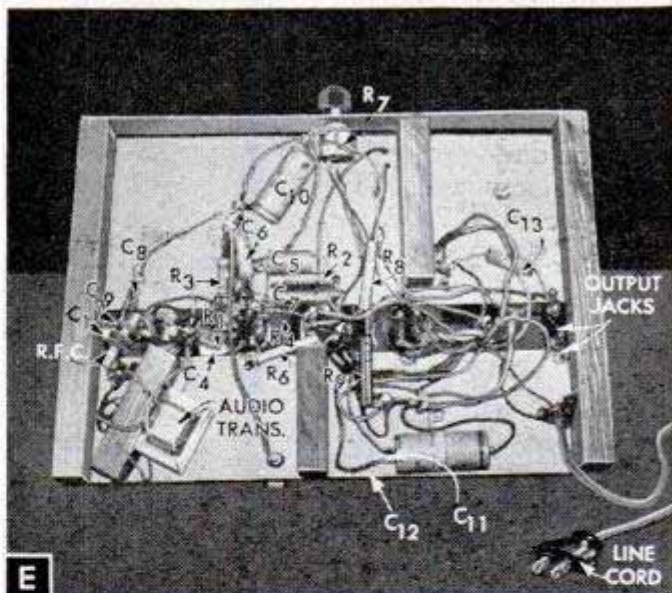
(Continued from page 231)

bands, but it is highly useful for reducing the volume on strong standard broadcast stations.

The loud-speaker is separate from the receiver and may be housed in a cabinet or mounted on any type of baffle that the



builder desires. The output transformer is to be mounted directly on the speaker, the primary leads being connected to a short 2-conductor cord provided with pin-jack plugs that are inserted in the jack strip. The speaker output transformer can be either the universal type indicated in Fig. 2 or any ordinary 5-watt output trans-



former with a 7000-ohm primary and a 3 1/2-ohm secondary. The speaker should always be connected to the jack strip before the power is turned on.

Test the receiver first on the broadcast band; plug in the standard broadcast coil and if everything is working properly you should have good volume on all local stations with only a 10-ft. indoor wire for an antenna. A good outdoor antenna will give

(Continued to page 236)

HOW TO TEST for a TRUE EDGE

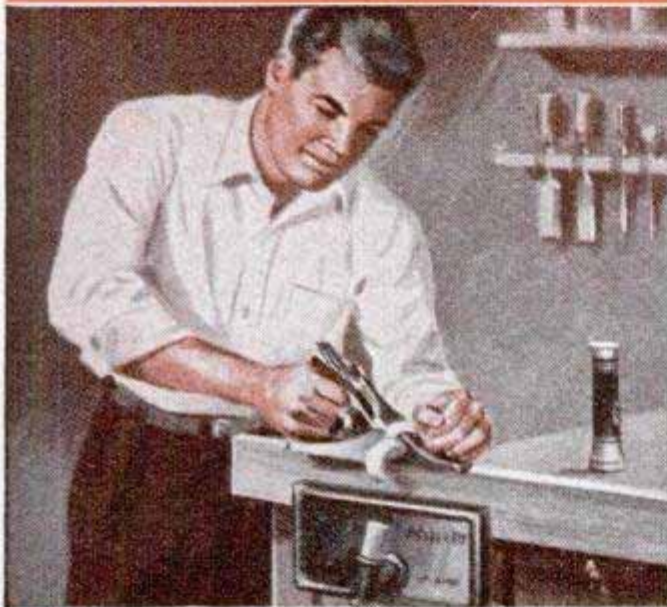
A simple trick
to help you
"do it better"

● You've planed a board till it's slick and flat as a pane of glass . . . or at least you *think* so. "Now," you say to yourself, "I'll have a true edge for a perfect joint."

Well . . . maybe you will. And maybe you won't. But here is one way to be absolutely certain.

1 Place the planed edge on a surface you know to be absolutely straight — a straightedge if available. Then take your flashlight, powered with "Eveready" batteries (they outlast all other brands*), and . . .

2 . . . let the penetrating light from the flashlight play along behind board's edge. If joint is tight, is perfect, light won't get through. If there's an irregularity, light will come through. Simple, isn't it? And 100% sure!



Proof! . . . in the laboratory . . . in your own flashlight . . .

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OUTLAST ALL OTHER BRANDS!***

Brighter light, longer life! That's what you want in a flashlight battery. And that's what you get with "Eveready" brand batteries. Laboratory tests prove it. And the best "laboratory" of all—*your own flashlight*—proves it! That's why "Eveready" batteries *outsell* all other brands—because they *outlast* all other brands!*

*According to the "General-Purpose 4-Ohm Intermittent Test" of the American Standards Association, which most closely approximates average use.

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best results on both the standard broadcast band and the short-wave bands. For the short-wave bands, it must be as high and as long as you can make it. Good quality insulators are also essential for maximum results on distant short-wave stations. On the broadcast band, the receiver will work with just about any setting of the antenna tuning condenser (C1). For short waves, however, this condenser should be set at the maximum value (screw in) which will allow the set to oscillate on the band being tuned. If too much antenna coupling is used (condenser closed too far) the set will not oscillate. If insufficient coupling is used the signals may be weak. Detailed student material list R-363 for this complete 3-tube a.c. receiver is available from Popular Mechanics Radio and Electronics department upon receipt of ordinary letter postage.

Hunting Big Fish Under the Ice

(Continued from page 151)

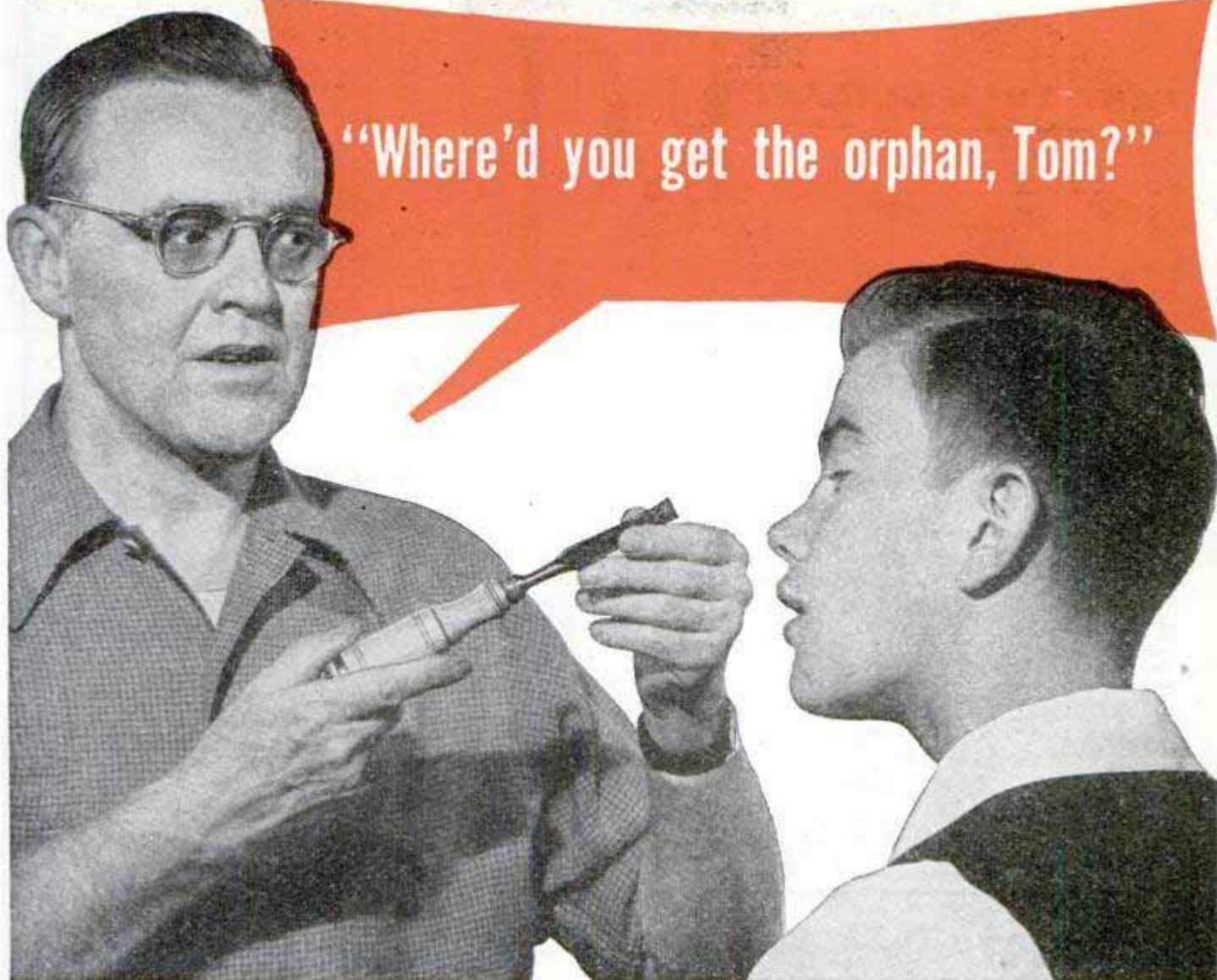
74-year-old retired blacksmith, makes the "best sturgeon spear in the world." He will let no spear out of his tiny forge shop until he knows its five tines are perfectly tempered, until the beards on the tines are at the exact angle. Some spears are just hammered out and sharpened. But a Thuerwachter spear takes at least a day's work. He draws out his tines and lays them back in a long manual process.

His spears fit loosely at the end of an 8-foot, 1/2-inch water pipe. Once the spear is plunged into a sturgeon it comes loose from the handle, but a two-foot-long "tumbling line" connecting spear and handle holds the fish. It may writhe and tumble in the water without getting purchase to free itself. The tumbling line itself is painstakingly made out of 48 strands of linen harness thread braided into a four-strand rope. It is soaked with harness pitch. Spearmen will tell you:

"There isn't a sturgeon in Winnebago ever broke one of Ed's tumbling lines."

Even with a detachable spear the spearman has a tough time landing a big fish if the tines did not injure the fish's spine. If the spine is hurt, the sturgeon can be handled with a minimum of effort. But it takes plenty of strength to hold the fish on the line until he tires himself out and then drag him through the hole. A 100-pound sturgeon is powerful. Many times a thrashing monster has been hauled into a little shanty only to knock over the stove and tear up the floor boards in its mighty protests. Then the trick is to get him out of the shanty onto the ice.

(Continued to page 240)



TOM: Orphan? What do you mean, Dad?

DAD: This chisel. There's no brand name on it.

TOM: What of it? Just feel that edge.

DAD: That's not much to go by when you're buying a chisel, son. Even a piece of cheese can have a sharp edge, you know.

TOM: You mean this chisel's no good?

DAD: I mean you can't be *sure* it's good. No brand name, no reputation to back it up. It's one of those bargain counter orphans—and they generally let you down.

TOM: Well, it didn't cost much, anyway.

DAD: Better get your money back—if you can. And then go over to the hardware store and buy a *good* chisel—one with an advertised brand name you can trust. The hardware man will always steer you right.

**Your HARDWARE DEALER sells QUALITY tools
and hardware... Buy from HIM**



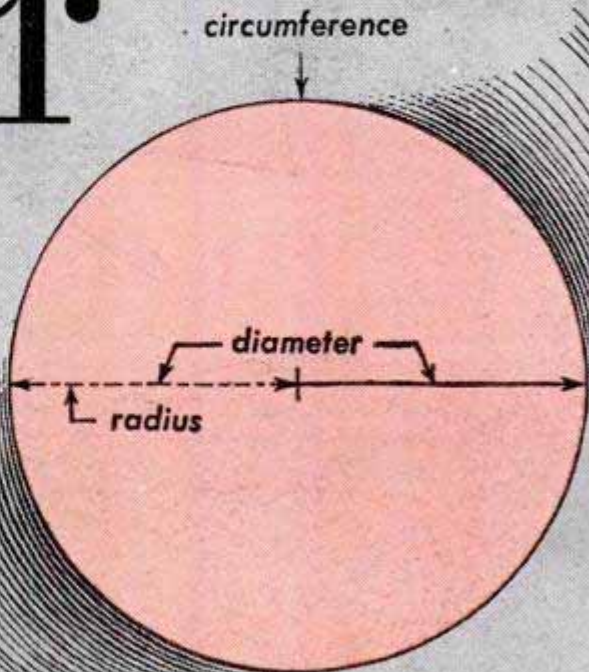
POPULAR MECHANICS

TEST YOUR SCIENCE

i.q.

Answer to Problem on Page 105

The distance between earth and tape measure is about 1/2 inch—exactly the same as in the case of the nine-inch orange with its 12-inch belt. It's a simple matter of mathematics. The circumference of any circle is pi (3.1416) times its diameter; the radius is half the diameter. If you add three inches to the circumference of any circle you add about one-third that distance to its diameter, or one inch; and its radius becomes 1/2 inch longer.—By Rex Taylor



$Circumference = dia. \times \pi (3.1416)$

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and
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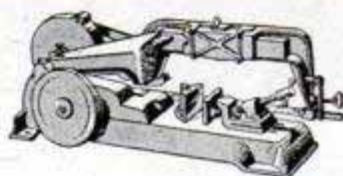
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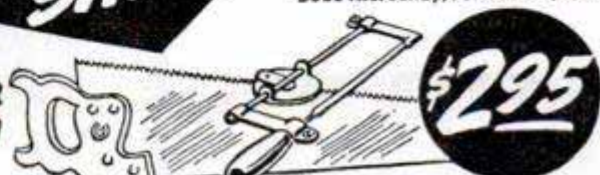
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Here comes happiness!" It's the world's greatest sport — and it's yours with a Harley-Davidson! Owning a Harley-Davidson Motorcycle is easier than you think. See your Harley-Davidson dealer today. Fill out and mail the coupon now.



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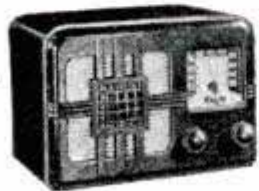


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Name.....
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City.....Zone.....State.....

Stalking the shadowy sturgeon requires patience and practice—and more patience. Sometimes a man may sit out the entire season without so much as a glimpse of a sturgeon. Then again, like Bernard Bergen of Malone, and his brothers, Bill and Orlando, he might run into a school of sturgeon. In an hour's time during the 1946 season this trio speared three sturgeon—ranging from 58 to 112 pounds.

Sometimes it's luck. I knew two brothers who did a lot of spearing. Each had his own shanty. They had speared many a fish in their time, but never a real big one. One was always complaining about it.

Then came the afternoon of his big chance. He took careful aim and hit his quarry squarely. That big boy just straightened out the 30-foot rope while his would-be captor tried to slow him down. The fisherman got a severe case of rope burn for his trouble. The sturgeon never stopped. He snapped off the rope close to the spear and was gone. After the ice had gone out the next spring, that sturgeon was found washed up on shore with the spear still in his tough old hide. He was seven feet long and had weighed well over 200 pounds.

Veteran spearmen say the best spots are over mud flats because sturgeon feed on insect larvae, mollusks and a blood-red worm found in the mud. The sturgeon noses into the mud with its spadelike nose to free the worms. Muddy water, however, is the sturgeon stalker's biggest headache. Some years the lake is so clear that you can read headlines on a newspaper sunk 18 feet down to give the fish a white background. Another trick is to spread tinfoil, bits of broken white plates, or even large slices of white, raw potatoes on the bottom of the hole.

Many use decoys—usually green or red-painted wooden models of sturgeon suspended below the hole on a string and sometimes manipulated. Game Warden Charles Schlumpf of Fond du Lac, who made a study of sturgeon, says it's a curious fish that likes to examine objects in the water. Other fishermen use tin cans, oranges and lemons, or big ears of bright yellow corn in the same fashion. The depth of the lure varies with conditions, but usually is not too far off bottom as the sturgeon is a bottom feeder.

Sturgeon-fishing fanatics don't mind the monotony of waiting. As they stare into the green depths they are often entertained by schools of walleyes. Now and then a big gar swims by. They tell, too, of muskellunge up to 50 pounds nosing the decoys. (It's illegal to spear muskies in Wisconsin.)

(Continued to page 246)

IT'S A GRAND FEELING, TO BUILD A WINNER

Mr. Robert Brightman, photography editor of *Mechanix Illustrated*, is shown displaying Walter A. Musciano's splendid 32-inch control line model of the plane that Frank Hawks flew to fame in 1930. It has won two first prizes so far.



*IT'S A GRAND FEELING, TOO,
WHEN YOUR CAR IS
CUSHIONED WITH MARFAK
CHASSIS LUBRICATION*

THAT CUSHIONY FEELING LASTS LONGER WITH MARFAK!

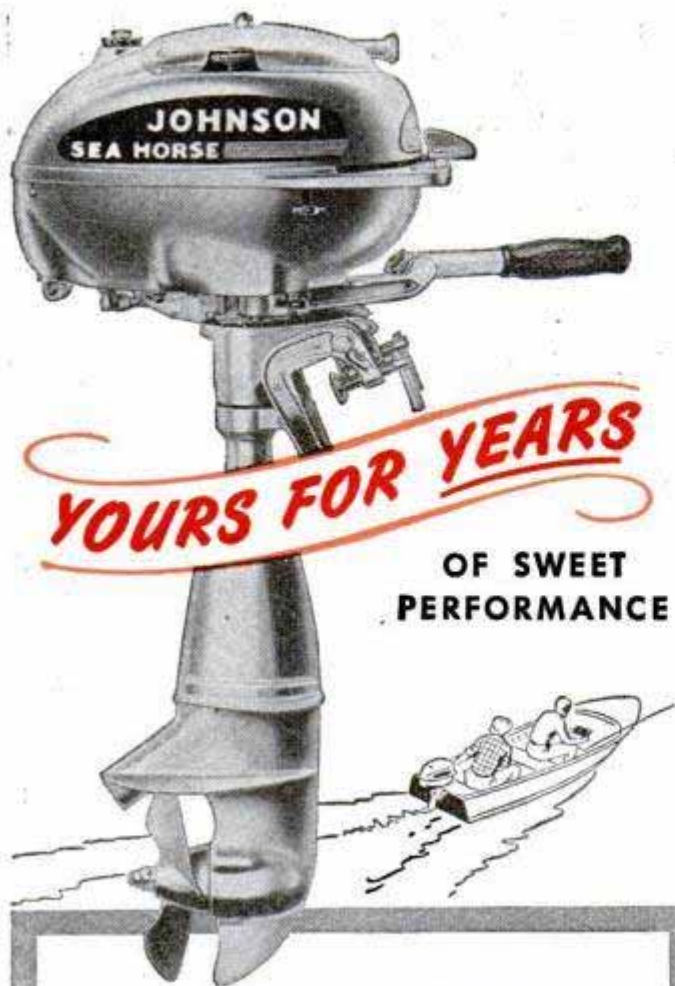
The smooth, easy handling of a car with *Marfak* Chassis Lubrication is evidence that a tough, long-lasting lubricant is on the job. A *Marfak* job protects your chassis for a thousand miles or more. Ask your Texaco Dealer to give your car that "*Marfak* feeling" ... today!



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for Homemakers

As a service to our readers in solving the hundreds of problems pertaining to a home—inside or out—the editors of *Popular Mechanics* invite you to present your problems to The Clinic Editor for help and advice. Address your questions to The Clinic Editor, *Popular Mechanics Magazine*, 200 East Ontario Street, Chicago 11, Ill.

Sink Drain Clogs Quickly

Q—Our sink drain clogs easily because it runs horizontally to the vent pipe in the wall. Is there any way to simplify this frequent cleaning job?
T. B.—Harvey, Ill.

A—Substitute a pipe tee for the elbow where the trap connects to the horizontal pipe. Install the tee in the same plane as the pipe. You can then get at the pipe for cleaning it by simply removing a plug which closes the unused end of the tee.

Yellow Stains on Piano Keys

Q—How can I remove yellow stains from the ivory keys of my piano?
W.H.R.—New York City.

A—Wipe them with a cloth dampened with alcohol and sprinkled with powdered chalk. There is no effective treatment if the keys have yellowed throughout because of age.

Removing Stains from Concrete Floor

Q—Is there a safe method of removing oil stains from a concrete floor near our oil-burning heating plant?
I.A.P.—Colorado Springs, Colo.

A—Cover the stains with dry portland cement to a depth of 1/2 in. In a few days the cement will absorb the oil from the concrete, especially if the stains are fresh. Dry hydrated lime also is effective. Another method is to wash the stained spots with a hot solution consisting of trisodium phosphate, 4 oz., and water, 1 gal. All traces of the solution should be washed away with clear water.

How to Repair Rusted Eave Gutters

Q—A spot on one of the eave gutters of my home has rusted through at the bottom so that it leaks. Can you recommend a repair?
J.O.B.—Aurora, Ill.

A—Cut a piece of heavy canvas large enough to cover the spot and reach to both sides of the gutter. Soak the canvas in white lead or other heavy outdoor paint. Then clean the leaky spot thoroughly and paint it. Place the canvas inside the gutter over the leak and smooth it. When dry, give the canvas another coat of paint.

White Spots on Furniture

Q—Perfume bottles set on my vanity dresser have caused several white spots on the finish. How can I remove them?
B.A.W.—Mobile, Ala.

A—First rub the spots with a cloth dampened with spirits of camphor and then rub them briskly with a dry, soft cloth.

(Continued to page 244)

Revolutionary New



Dumore Carvit

makes you a skilled wood-carver in 20 minutes!

Here's a fascinating new hobby—complete in one tool. The unbelievable perfection of your first carving amazes your friends! Experienced craftsmen use the Carvit to give their woodworking projects

that professional touch.

With the Carvit, you make beautiful replicas of inexpensive objects you can find in any dime store or gift shop—in mahogany, walnut, and other fine woods.

You're an expert at once — with a Carvit!

Here's how the easy-to-use Carvit works: You clamp a model to the table below the tracer, and a wood block below the cutter. Then you switch on the motor and guide the tracer over the raised contours of your model. The cutter moves with the tracer to carve an exact duplicate of the model. With an index

attachment, you can carve objects in the round—statuettes, busts, etc.

Carving with the Carvit is fascinating fun for everyone. The Carvit is the ideal gift for your sweetheart, husband, or son! See this exciting new tool at your local hardware store today — or mail us the coupon below!

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H-5

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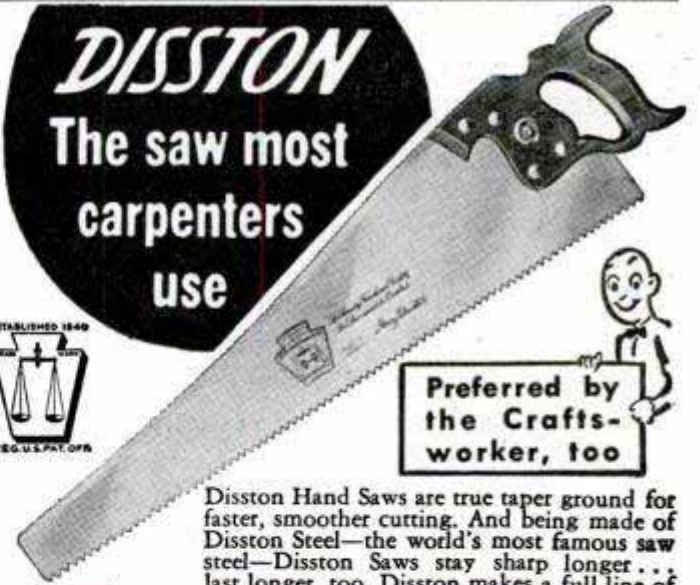


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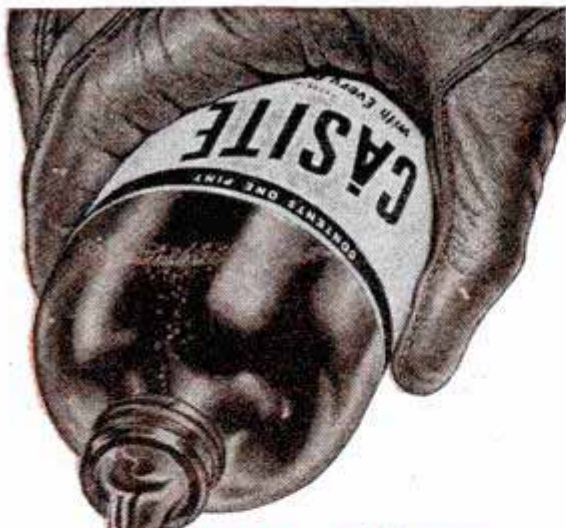
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Preventing Noisy Radiators

Q—We keep the valves on some of our steam radiators partially closed to regulate the heat, but when we do they pound. What causes this noise?
R.A.D.—Rochester, N.Y.

A—When the valves of steam radiators are partially closed, the passage through the valve is too small to permit both live steam and water from the condensed steam to pass through it at the same time. As a result water collects in the radiator and causes the live steam to enter in spurts, which causes the noise. The only way to eliminate the noise is to keep the valves completely open.

Removing Calcimine

Q—What is the best way to remove calcimine?
J.A.C.—Wilmington, Del.

A—Calcimine usually can be removed with a sponge and warm water. Go over a small patch with the wet sponge to soften the calcimine, wring out the sponge and then wipe off the softened calcimine. Household ammonia added to the water will help. A handful of washing soda to a gallon of water also is helpful. If the soda solution gets on painted walls or woodwork, it should be wiped off immediately to avoid damaging the finish.

Repair for Cracked Laundry Tub

Q—Is there any way I can repair a crack in one of our laundry tubs?
D.R.B.—Akron, Ohio.

A—If the tub is made of concrete, slate or soapstone, enlarge the surface of the crack by grooving so that a soft cotton string can be forced into it. Coat the string with white-lead paste and force it into place. Allow several days for the lead to dry before using the tub. Filling the crack with a paste of glycerin and powdered litharge also is effective.

Moisture on Window Sash Rots Wood

Q—The wood at the lower end of each glass pane of our windows is starting to decay because of moisture condensing on the glass and running down on it. Is there any way to protect the wood?
P.R.C.—Minneapolis, Minn.

A—Sand off the damaged wood and give it a coat of shellac and then repaint. A coat of shellac over the paint on undamaged windows will protect them.

Copper Screens Stain Exterior Walls

Q—We installed copper screens last summer and rain water running off the screens is staining the wall underneath. How can I prevent this trouble?
S.A.R.—La Porte, Ind.

A—Paint the screens with clear lacquer. Repeat at intervals of two or three years.

Water Shut Off Temporarily by Freezing

Q—I have a damaged fitting in a water line which I wish to replace, but have no means of shutting off the water for the short time necessary to replace the fitting. Can you suggest something?
R.O.B.—Enid, Okla.

A—Pack dry ice around the pipe for a distance of 4 or 5 in. on the pressure side of the fitting, using a strip of canvas or other heavy cloth to hold the ice in place. The ice will freeze the water inside the pipe and thus plug it. Remove the ice as soon as possible after completing the repair.

Paint on Plastered Wall Is Spotty

Q—The paint on a newly plastered wall in our home is becoming spotty. The paint seems to change color where these spots appear. What causes this condition?
S.R.W.—Bonaparte, Iowa.

A—Likely your trouble is caused by "hot spots" in the plaster. Actually the spots are not hot, but are caused by the presence of unslaked lime in the plaster which attacks the oil in the paint. Brushing the spots with a solution of zinc sulphate, 1 or 2 lbs. to water, 1 gal., will prevent the trouble. Repaint the spots. If the plaster has been applied less than one year, it would be a good idea to go over the whole wall with the solution and then repaint it.

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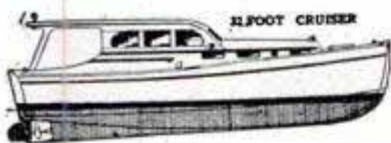
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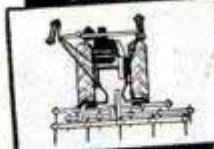
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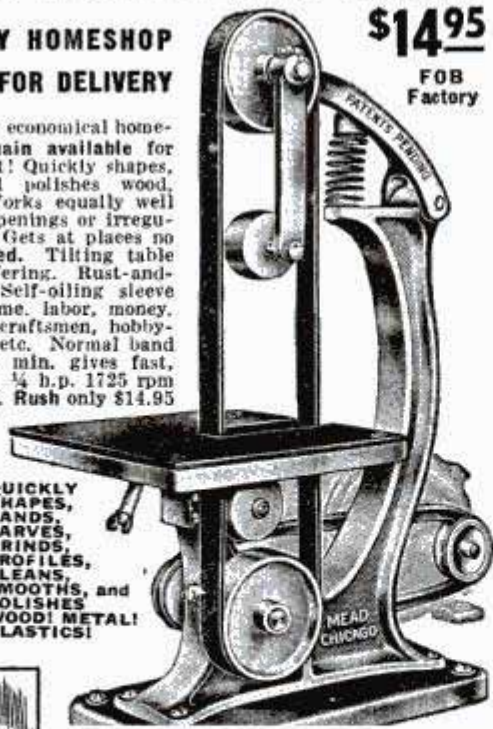
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Techniques differ, but most fishermen are anxious to "get the iron into 'em." Absolute quiet is essential; shuffling feet on the shanty floor scare away the wary, sensitive "shadow." So does the thump of the spear carelessly snatched from its hook on the ceiling. Veteran Delmer Weenink operates on this theory:

"I let a sturgeon come in and look over the decoy. Then when he starts to move away I let him have it. I think they're like deer. You take a big buck standing there looking at you, eyes focused. He'll jump if you move. So you stand still and let him calm down and let him start to move off. That's the time to shoot. It's the same with sturgeon. When they start to move away slowly, they're looking at something else. That's the time to reach for your spear."

There are some 50 or 60 types of sturgeon. All are ugly. All have long, horny snouts and an elongated body covered with tough skin. The Lake Winnebago sturgeon has a dark gray or olive green back and a whitish gray belly. The mouth is small and toothless and is on the underside of the muzzle, with an eye and nostril on each side of the snout. Sometimes in summer they startle fishermen by leaping five feet out of the water to shake off the parasitical lampreys.

All sturgeon are relished for their firm white meat. The sturgeon has no bones other than the backbone and cuts into nice, horseshoe-shaped steaks. While the Winnebago sturgeon taken through the ice does not usually have eggs sufficiently developed for caviar, other types are prized for this. The Russians catch four kinds of sturgeon ranging from 20 to 3000 pounds in the Caspian Sea. The largest is the great white beluga, a good producer of caviar.

Lake Winnebago sturgeon have been known to reach the age of 100 years. The female does not spawn until she is about 25 years old. Wisconsin—by limiting the catch to sturgeon at least 30 inches long—gives the fish about 20 years of freedom from the spear. Sturgeon have no scales. On some other fish, scales reveal age by ring growths—much as trees do. Scientists have had to count the markings on the sturgeon's otoliths—or "ear stones"—under the microscope. Otoliths form inside the head, one on either side, and are similar to a part of the inner ear in man and animals.

Most people prefer smoked sturgeon, but it is also served fried, boiled or pickled. To a sturgeon fisherman, the eating is only a minor part of this major winter sport which affords more thrills than the highest ski jump.

Your weight does the work
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**QUICK-RETURN SPIRAL
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● Save your wrist: drive and draw screws faster. Just push on a "Yankee" 130A Spiral Driver. Your weight and the spiral turns the screw without blisters or fatigue. Quick-return spring in handle holds blade in slot and returns the handle after every stroke.

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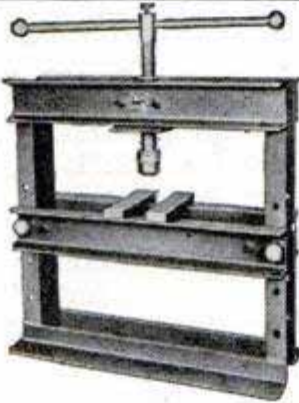
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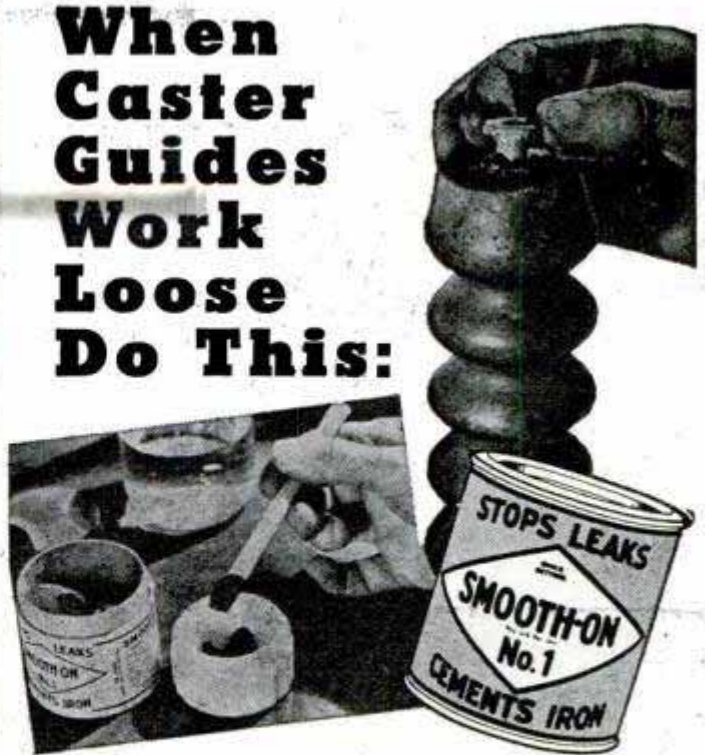
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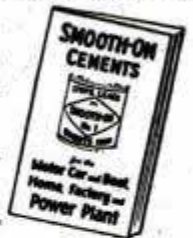
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SAY YOU SAW IT IN POPULAR MECHANICS

Has the Propeller a Future?

(Continued from page 174)

efficiency was upped to 80 percent at 530 miles an hour.

This suggested further experiments. Instead of making propellers with round blade shanks, why not continue the blade itself right into the spinner? Now efficiency jumped to 91 percent at 200 miles an hour and an encouraging 88 percent at 530 miles an hour. Then researchers went to work. They swept blades forward, backward, and tried all kinds of shapes.

Typical of the results is one study that shows exceptional promise for the future. This amazing blade shape is simply an isosceles or two equal-sided triangle twisted to form the screwlike propeller blade. A 12-foot-diameter propeller of such design is expected to be 80 percent efficient at 840 miles an hour and would absorb as much as 18,500 horsepower. This is at least six times the power absorption of comparably sized props of the late war. And, if the triangle were swept back like other trick blade shapes being tried, it would prove capable of still greater performance.

The propeller and engine or turbine combination is considered superior to jet and rocket propulsion at all speeds below that of sound. Only at supersonic speeds, where efficiency and economy are not always most important, are the rocket and jet supreme. Once compressibility is encountered an 800 percent increase in power is needed for every 20-mile-an-hour increase in speed.

Fuel consumption is greater with the jet. When the eight-turbine jet-propelled B-49, sister ship to the propeller-driven B-35 Northrop flying wing, was built, it proved to have half the range of the older ship though its speed was increased. Particularly because transport airplanes can make money only at subsonic speeds, authorities agree that the propeller has a bright future.

Major General Laurence C. Craigie, chief of the engineering division of the Air Materiel Command at Wright Field, said in a speech, "Our combat aircraft, for an interim period at least, will remain in the subsonic range. So far as power plants are concerned, the reciprocating engine is still our best bet for long-range, substratosphere flight at subsonic speeds. However, the propeller-driving gas turbine gives indication of becoming strong competition."

Ships like the Ryan Fireball, with one turbine in the nose for the propeller and another in the tail for the jet, operate at

(Continued to page 252)



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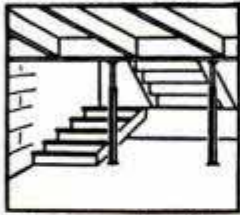
(In Canada: Send order to Stanley Tool Co. of Canada, Ltd., Roxton Pond, Quebec.)

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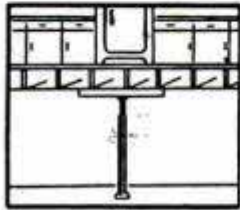
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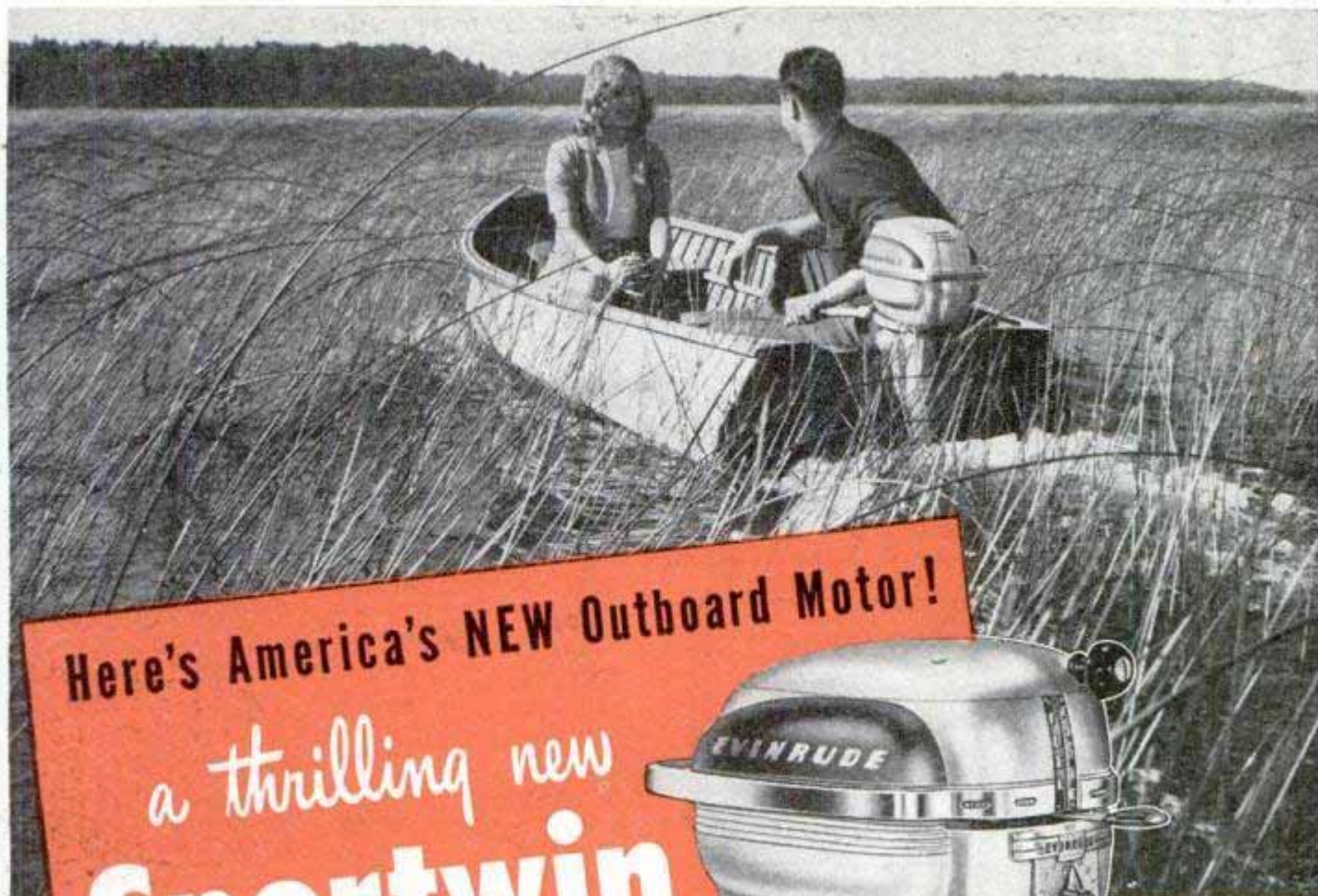
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FEATURES

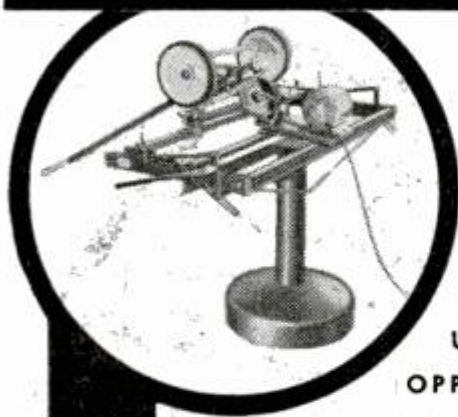
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Make more money the Modern way! Everywhere grass grows and lawn mowers are used offers you unlimited opportunities to make up to \$1000.00 per month in a business of your own. For the first time in history, you can sharpen any reel type lawn mower from a five inch edger to a thirty-six inch power mower in from ten to twenty minutes. Dismantling is unnecessary. Handle, wheels, roller and motor remain in place when sharpening even the most complicated mower. The Modern Lawn Mower Sharpener eliminates all hand filing. It precision grinds to extreme ends of both left or right twist reel blades. Bottom knife is held in same brackets for sharpening. No extra attachments required for grinding. Hand, power, gang or fairway units sharpened equally fast . . . equally easy for greater profits. Anyone can operate the Modern Lawn Mower Sharpener. It is simple in design and simple to operate. Send for details today!

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better than 500 miles an hour with propellers quite similar in appearance to wartime paddle-blade designs. More powerful turbines already on the way point to propeller-equipped fighters as fast or faster than the Douglas Skystreak.

George W. Brady, chief engineer of Curtiss-Wright's propeller division, thinks there are two ways of suitably improving prop designs for the fast planes just around the corner. One is to use thin blade sections, and the other a more radical idea for exposing to the wind stream only those parts of the propeller that produce thrust. Brady visualizes an interesting fanlike arrangement, as shown in the drawing of a future gas-turbine propeller.

A cross section of the hub portion of this propeller would reveal a double spinner (another NACA development), with the regular spinner inside a larger spinner whose lines flow nicely into the lines of the airplane fuselage. Between the two spinners is a passage to permit the flow of air to the turbine. Thus, the propeller-blade shanks would be entirely removed from the air stream. With a three-foot-diameter spinner, the eight-bladed prop would absorb 8000 horsepower with an efficiency of 81.5 percent at 500 miles an hour, and 74.5 percent at 700 miles an hour. As many as 10 blades may be used. The relatively small diameter of 10 to 12 feet compares with wartime designs.

The peculiar operating characteristics of the turbine affects propeller designs and even the installation of the power plant itself. Since a turbine operates most efficiently at the maximum number of revolutions per minute permissible for continuous operation, one proposal calls for a "double turbine" driving one propeller, the idea being to declutch one turbine when the plane reaches cruising altitude.

Because of widespread feeling that the turbojet will replace the propeller on all high-speed aircraft, it is interesting that the theoretical turbine-propeller fighter greatly outperforms the pure jet with the same power plant at the same rate of fuel consumption. The speeds are approximately the same but the propeller version takes off in half the distance, climbs twice as fast, and can turn 1200 feet inside the jet job at a practical maneuvering speed of 350 miles an hour.

Although odd blade shapes and other radical developments catch the eye, many other important strides are being made in the propeller world. Typical is the Hamilton Standard hollow steel blade, which provides reasonable lightness with great

(Continued to page 256)



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A new design... strong... adaptable...
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(All units $\frac{3}{8}$ " Square Drive)
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 —Complete in a metal box,
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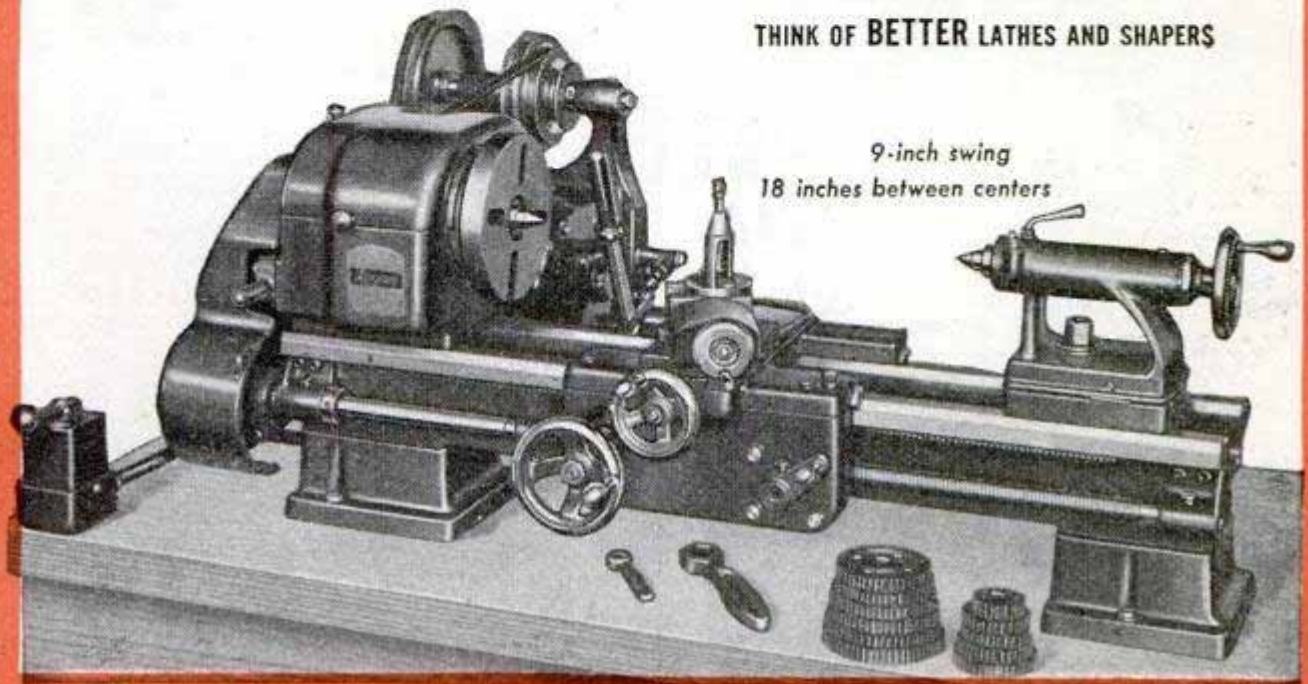
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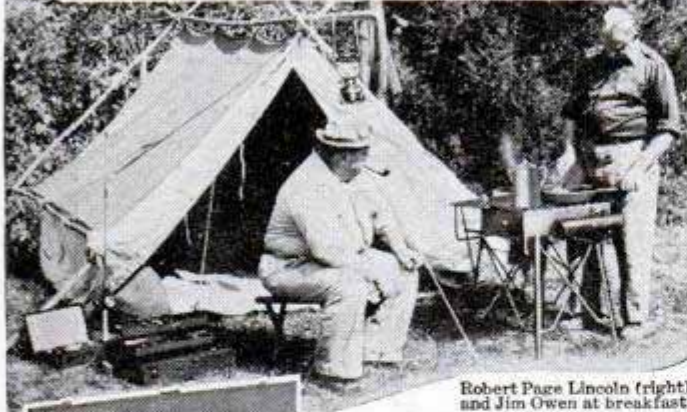
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The Coleman Camp Stove makes and burns its own gas from gasoline—cooks like city gas! Just set up—light up—and you're cooking. Two big windproof burners—easily removable tank. Ask your dealer for a demonstration!

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strength for the blade's large area. Its sponge-rubber filling has been heated and expanded to form a light, hard mass that prevents the blade's thin walls from "breathing" or moving in and out. Through the sponge rubber runs a fine network of electric wires which heats the leading edge of the blade for de-icing.

Curtiss-Wright solves the same problem by feeding heated air into the hollow blade. Fast automatic feathering devices now turn the propeller blades edgewise into the wind, in case of engine failure, in far less time than it formerly took a pilot to react and move the feathering controls. But no pitch-changing or governing device now in use will do for the turbine.

The kinetic energy of the whirling mass of the turbine makes it impossible for this type of power plant to respond quickly enough to changes in speed control. Pitch changing on present-day propellers is taken care of automatically by oil pressure or by electricity. Some entirely new system must be devised for the turbine's propeller.

A pilot may want emergency power to correct a faulty landing approach. Since the turbine responds very slowly, it will be necessary for a pitch-changing device to function within one second to allow the turbine pick up before the plane strikes the ground. Such problems will be solved. Meanwhile, don't count the propeller out.

As one engineer told us, "A propeller blade is only a wing spinning in the air to develop thrust. Since it is a wing, you will find it around just as long as airplanes have wings. Anything they can do to a wing we can do to a propeller blade."

Hand-Carved Circus

(Continued from page 162)

the long pole wagon, band, ticket, dressing wagons, water, seat, calliope, baggage and the corral (horse) wagons. Altogether, there should be about 70 of them.

In World War II the Army went to the circus to learn efficiency in setting up and breaking camp, and your model circus must also be a model of efficiency.

The poles which the pole wagon carries must be right to support Neumann's 5 by 14-foot big top, with its 7500 seating capacity. The seats and the bleacher supports must fit precisely into the seat wagon, just as they do in the real circus, and they must be made for quick assembly on the lot. Packing 18 sections of the main tent into canvas wagons is an exacting job.

All the little gadgets must work. Doors must open; wagon tongues, numbered to

(Continued to page 260)

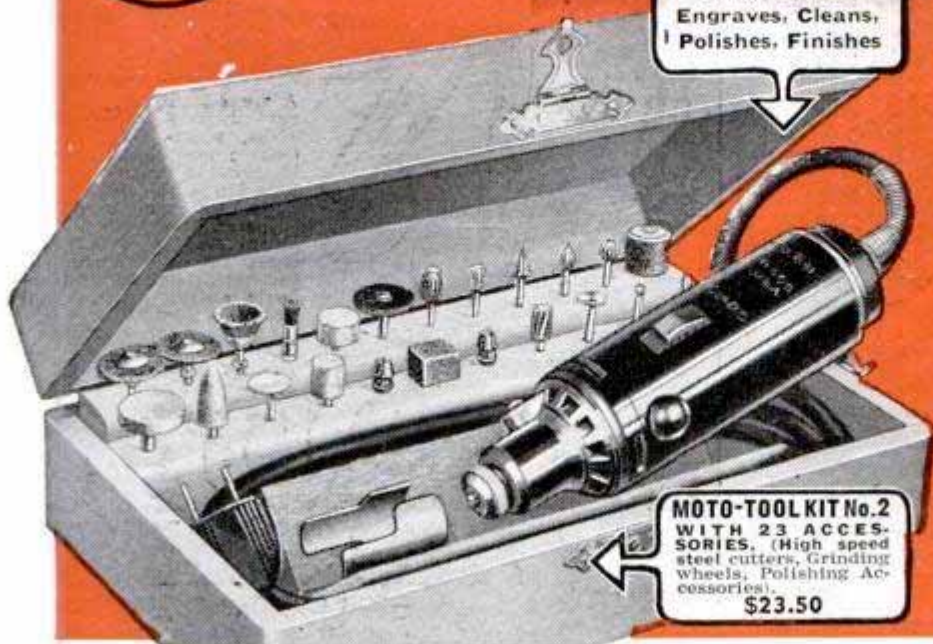


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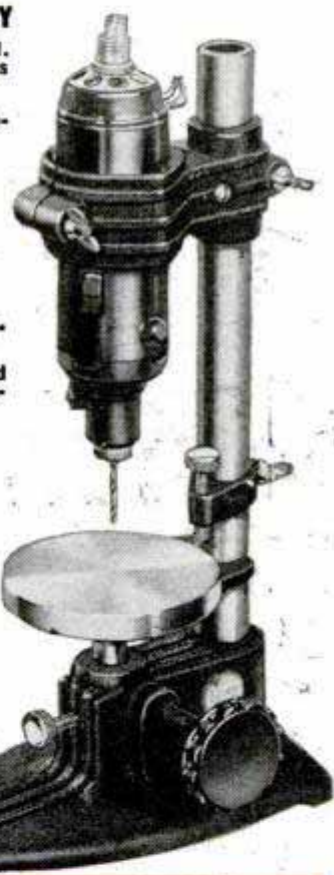
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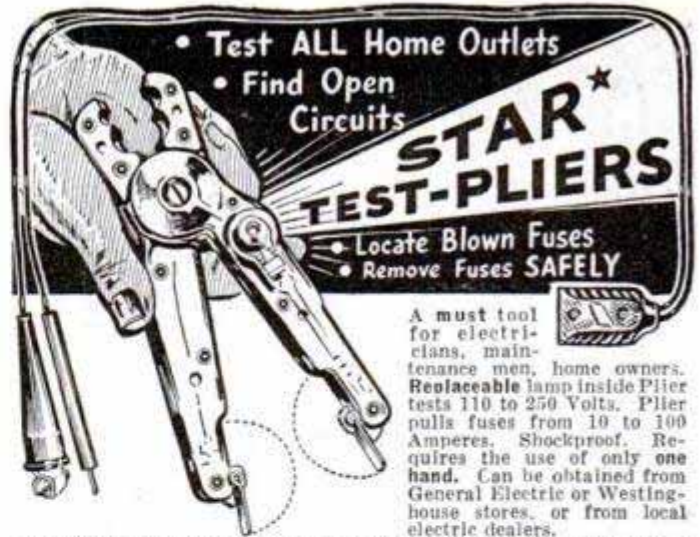
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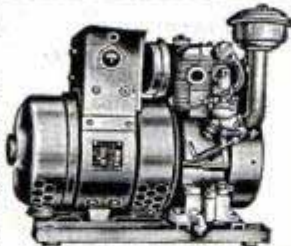
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Motorists Wise

SIMONIZ

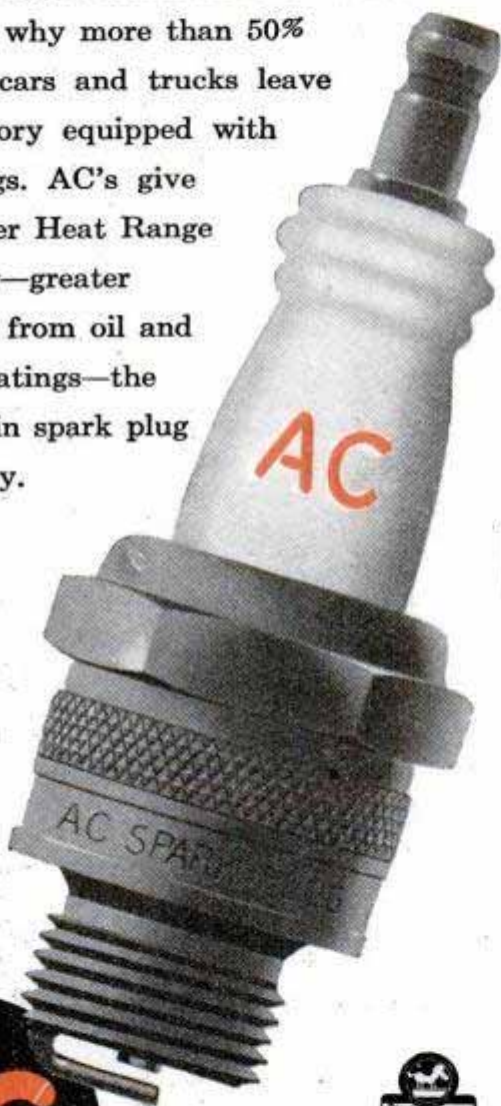
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wagons, must be removable for storage aboard the circus train; wheel trucks must also be detachable. Much of the authenticity comes in duplicating exactly the small equipment, apparatus and furnishings like tools, lot stakes, flares, ladders, block and tackle, rings and ring tubs.

Animals are difficult to carve, and a lot of them are necessary. Neumann's circus will need 40 teams of heavy horses, mostly Belgians; at least 15 wild animals for the cages, a 30-elephant herd and scores of other performing animals.

Construction of the circus train takes the hobbyist into model railroading, a hobby in itself.

Probably the easiest method of turning out the hundreds of human performers, workmen and audience is to carve a number of each in different poses, make plaster molds, and then cast them in lead.

If you're still a member of this world after all that, you can start "setting up" for the neighborhood kids.

Testing Ground for Grass

(Continued from page 168)

water at an average speed of eight feet per second. Because of Bermuda grass' tough roots, which form a durable matting, less than 1/4 inch of soil was lost.

In contrast with a sod-forming vegetation like Bermuda, "clump" grasses like buffalo grass offer only about half the protection. Water begins to scour on the upstream side of the clumps, and gulying starts. One of the better "clump" grasses, however, is weeping lovegrass which is easily established, produces a good hay or pasture crop and sometimes a valuable seed crop. If used in a drainage way, its limitations must be considered and the waterway designed accordingly. Even an excellent gripper like Bermuda grass has its maximum capacity.

Best method of propagating Bermuda grass in runoff channels on a farm is to plow the bottom of the channel, disk in a quantity of roots raked from any other area where this grass grows, roll, fertilize and water. In about a year the cover will have grown high enough to check erosion. Where speedier growth is required, sod from other areas is cut in strips and laid in place.

Where Bermuda grass is not available, other grasses were found to be fairly suitable in the following areas of the United States: buffalo grass—Texas, Oklahoma; Kentucky blue grass—Missouri, Ohio, Kentucky, Wisconsin; centipede grass—

(Continued to page 264)

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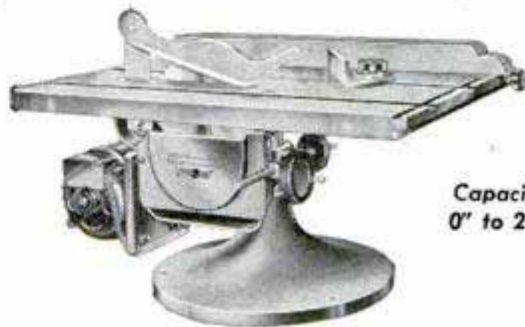
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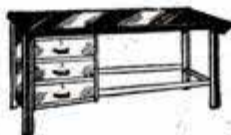
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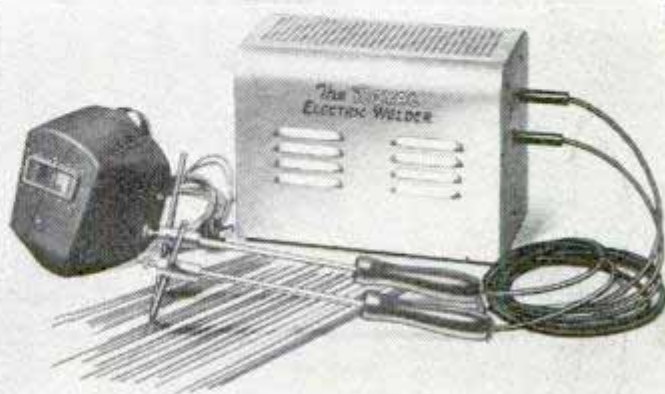
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Industrial Revolution in the Desert

(Continued from page 93)

is assisting in the financing of it. Here again the shifting of desert dunes was of first importance and knowledge was drawn from railroading experience in the "snow states" of the Middle West where it was found that elevation of roadbeds by 18 to 24 inches will cause blowing snow to "roll over" without leaving obstructing drifts.

In the planning stage is a second rail line connecting Jidda with the Holy Cities of Mecca and Medina. The third rail project is a restoration of the Hejaz line.

For a country that boasted not a single automobile 15 years ago, it is evident that development of these land and air transport systems will play a major part in future economy. Communications—telephone, telegraph and most of all radio—have kept pace.

Of great long-range import, also, have been experiments in scientific irrigation for agriculture. With American assistance—Aramco, Foreign Economic Administration and Texas Extension Service—a scientific farming project is in operation at Al Kharj, a natural oasis of some 3500 acres about 30 miles from Riyadh. Wells, pumps, irrigation ditches were combined with fertilization, crop rotation and other practices of modern farming. The demonstrated potentialities of the desert have been amazing in high quality and quantity production. To a farmer, perhaps the most

(Continued to page 268)

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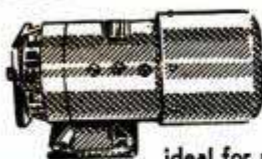
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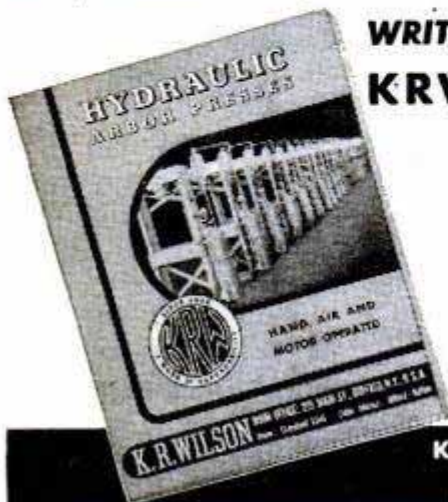
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POWER FOR LATHES — PUMPS — DRILL PRESSES — WASHING MACHINES — FANS — ETC.

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FOB
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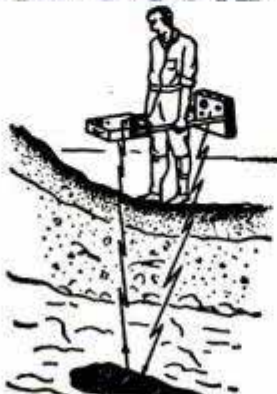


Unusual bargains in dazzling genuine diamonds which have slight imperfections. However, these do not mar the eye beauty of the gems, nor lessen their everlasting flash and fire! You will be amazed at the low prices.

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New sensational lightweight models, unsurpassed efficiency Low prices. Time-payment plan. Write for free 16 page booklet.



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are money makers for YOUR SHOP or GARAGE

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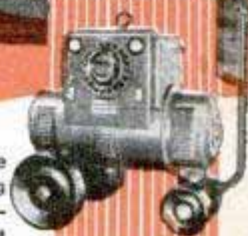
Save hundreds of dollars, build your own gasoline drive Hobart arc welder. You need only a Hobart generator, a used auto engine and chassis. With this portable gasoline drive welder, you can go any place. Free booklet tells you how. Write for details.

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ANCO® RAIN-MASTER®

WINDSHIELD WIPER BLADES and ARMS

**Blade snaps on—Stays put
Can't fall off—Can't blow off**



Don't Blame Your Gas-Pump Man!

Sure, he knows how dangerous it is for you to drive your car . . . in stormy weather . . . with dull old windshield wipers that *smear* and **SMEAR!**

He'll gladly put on for you—quickly—a pair of keen new ANCO RAIN-MASTER Blades—or Blades and Arms.

HE NEGLECTS YOU?

He has RAIN-MASTERS . . . But he forgets to remind you? Too busy?

After all it's *YOUR* car to protect. . . So, *YOU* ask *HIM* for RAIN-MASTERS next time you buy gas. . . . Patented features. . . . Original equipment on DeLuxe Models of high-grade cars . . . because RAIN-MASTERS *Clean quicker—Clean cleaner—Last longer.*

*Get yours—next time you buy gas.
May save you a costly smashup!*

Made by ANCO . . . makers of the new CLEAR-FLEX* Wiper Blade—the only Blade worth more than RAIN-MASTER. Costs more. Ask your good ANCO dealer to show you why.

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Quality Protected Under Fair Trade Laws
ANCO Patented Products—Patents Make Jobs

THE ANDERSON COMPANY
Established 1918
GARY, INDIANA

impressive statistic is that Al Kharj is now raising 18 cuttings per year of alfalfa, compared with a good average of four in the United States.

Another interesting development is the transformation, even in slight degree, in the nomadic Arab character. More than 9000 sons of the desert, never before pinned down to steady employment, are working for Aramco and nearly 400 have passed the 10-year mark in continuous service.

Thousands have left the company employ to apply their new skills to private enterprise and Aramco has set up an Industrial Development Department which applies itself solely to the task of training, organizing and launching the Arabs in private business. Ten years ago there were less than a half dozen private contractors in all Saudi Arabia; today there are more than 100 in such diversified enterprises as building, trucking, garaging, machine working, flour milling and brickmaking.

Dhahran, an American community of air-conditioned homes and buildings, is the headquarters hub of an oil operation extending over five proven petroleum fields and some 50 wells already in production. About 1600 American workers, nearly 200 of them with wives and families in the field, are employed and the total is expected to reach 4000.

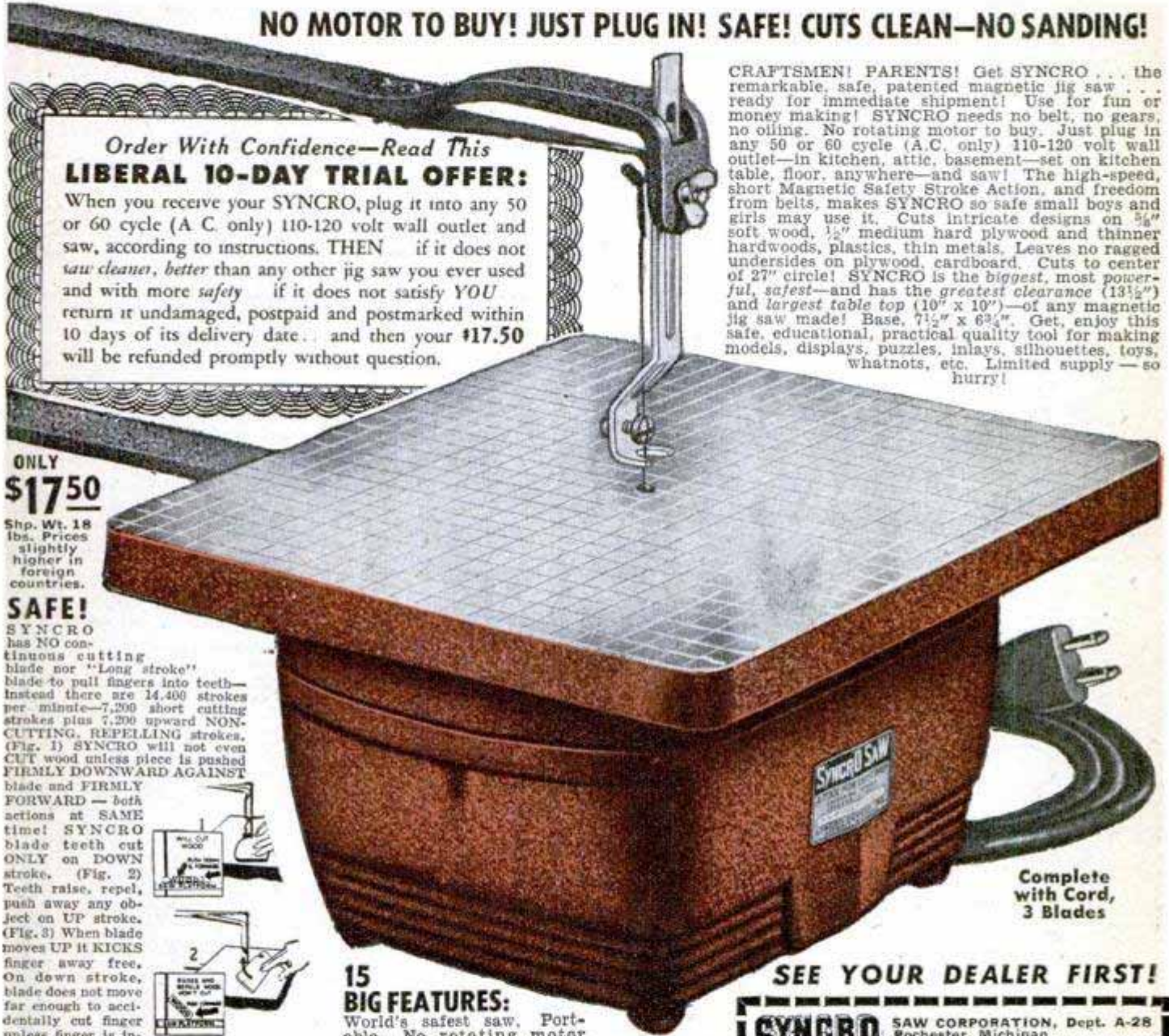
Daily production already has surpassed 280,000 barrels of crude oil, but it would take 60 years at that rate to exhaust the proven reserves. Production offers no unusual engineering problems and actually is under ideal control conditions to assure natural flowing pressure and maximum drainage of each oil deposit. Royalty payments are on a basis of 23 cents per barrel, guaranteeing the Saudi government nearly \$20,000,000 per year toward its present \$30,000,000 annual budget.

An Aramco refinery at Ras Tanura, about 50 miles north of Dhahran, takes about 120,000 barrels per day while another 105,000 barrels are piped daily to a refinery on Bahrein Island. The remainder is shipped out as crude oil.

The U. S. Navy has been the principal customer, but the long-range planning calls for diversion of a substantial daily tonnage to the European markets. Trans-Arabian Pipe Line Company, a subsidiary of the same American parents, contemplates building an 1100-mile pipe line from the Arabian fields to the Mediterranean, near Sidon, Lebanon, to transport 300,000 barrels of crude oil per day. This work, however, may be delayed by the political crisis over the Palestine situation.

BIG FUN and PROFIT using AMAZING NEW JIG SAW!

NO MOTOR TO BUY! JUST PLUG IN! SAFE! CUTS CLEAN—NO SANDING!



Order With Confidence—Read This LIBERAL 10-DAY TRIAL OFFER:

When you receive your SYNCRO, plug it into any 50 or 60 cycle (A.C. only) 110-120 volt wall outlet and saw, according to instructions. THEN if it does not saw cleaner, better than any other jig saw you ever used and with more safety if it does not satisfy YOU return it undamaged, postpaid and postmarked within 10 days of its delivery date. and then your \$17.50 will be refunded promptly without question.

CRAFTSMEN! PARENTS! Get SYNCRO... the remarkable, safe, patented magnetic jig saw... ready for immediate shipment! Use for fun or money making! SYNCRO needs no belt, no gears, no oiling. No rotating motor to buy. Just plug in any 50 or 60 cycle (A.C. only) 110-120 volt wall outlet—in kitchen, attic, basement—set on kitchen table, floor, anywhere—and saw! The high-speed, short Magnetic Safety Stroke Action, and freedom from belts, makes SYNCRO so safe small boys and girls may use it. Cuts intricate designs on 1/2" soft wood, 1/2" medium hard plywood and thinner hardwoods, plastics, thin metals. Leaves no ragged undersides on plywood, cardboard. Cuts to center of 27" circle! SYNCRO is the biggest, most powerful, safest—and has the greatest clearance (13 1/2") and largest table top (10" x 10")—of any magnetic jig saw made! Base, 7 1/2" x 6 3/4". Get, enjoy this safe, educational, practical quality tool for making models, displays, puzzles, inlays, silhouettes, toys, whatnots, etc. Limited supply—so hurry!

ONLY \$17.50

Shp. Wt. 18 lbs. Prices slightly higher in foreign countries.

SAFE!

SYNCRO has NO continuous cutting blade nor "Long stroke" blade to pull fingers into teeth—Instead there are 14,400 strokes per minute—7,200 short cutting strokes plus 7,200 upward NON-CUTTING, REPELLING strokes. (Fig. 1) SYNCRO will not even CUT wood unless piece is pushed FIRMLY DOWNWARD AGAINST

blade and FIRMLY FORWARD — both actions at SAME time! SYNCRO blade teeth cut ONLY on DOWN stroke. (Fig. 2) Teeth raise, repel, push away any object on UP stroke. (Fig. 3) When blade moves UP it KICKS finger away free. On down stroke, blade does not move far enough to accidentally cut finger unless finger is intentionally, deliberately fed into blade like wood is fed in Figure 1. No wonder SYNCRO is the world's SAFEST saw... a feature old and young users acclaim!



15 BIG FEATURES:

World's safest saw. Portable. No rotating motor needed as self-contained magnetic power unit transmits A.C. magnetic impulses to armature diaphragm—power transferred to blade. No rotating parts to wear out. 14,400 magnetic strokes per minute. Never needs oiling. Large 10" x 10" table top. Cross section engraved lines on top. Big 13 1/2" throat clearance. Finest steel blades. Rubber feet. 5' cable, plug. Varying voltage adjustment nut. Life-time, durability. Quality materials, workmanship, performance.

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 I enclose no money — send FREE SYNCRO CIRCULAR.

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SYNCRO

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WORLD'S LARGEST MAKERS OF ELECTRIC JIG SAWS

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If no dealer near you, mail coupon with Postal Note, Money Order or check for only \$17.50 plus Parcel Post or Express carrying charges... or... send \$17.50 only and we will ship saw collect for Parcel Post or Express carrying charges only. Specify type of delivery on Coupon. Shipping weight, packed, 18 lbs. Hurry! Act promptly—order—we'll ship same day order is received. (No complete COD orders accepted.)

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WITH
NEW COATED OPTICS

- Inter-Pupillary Adj.
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Now you can be sure of "Up Front" pleasure from "way back!"

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Originally a \$60.00 value! A perfect item for farmers, repairmen, truckers, hunters and ranchers. Fleece, fluffy, sheeplined throughout. Full zipper-collar tabs—All leather shell. Unbeatable for sheer warmth. In sizes from 36 to 40. Best buy in America!

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Biggest jacket seller in the nation! Judged the favorite among drivers, routemen, laborers, students and sport enthusiasts. Features Mouton Lamb Collar, All Wool Alpaca Lining! Full zipper, knit cuffs and waist, snap pockets. In all sizes . . . Hurry, while they last! (BRAND NEW!) Sizes 36-46..... **\$15.88**



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Here is an item that is excellent for the car, home, barn and stadium. The 100% wool blanket that is the All time G.I. favorite. Sturdy... really keeps you cozy! Like New..... **\$4.88**

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These are the boots that kept air crews' feet warm at sub-zero altitudes! All sheeplined, rubber soles, leather upper, full zipper. Small - Medium - Large. (Like New)..... **\$5.88**

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Made for GOBS of warmth and comfort! 100% sturdy brush wool and BRAND NEW! High collar protects you from whistling winter blasts. Deep, roomy slash pockets . . . An ideal coat for outdoor folks seeking high value at the lowest cost. Sizes 36-46.... **\$16.88**



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Plate GOLD - SILVER - CHROMIUM, etc.
It's Profitable - Simple - Pleasant

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Write for further information, or ORDER your KIT **\$14.75** NOW! ONLY.....

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The new THOR "B" — Sensational miniature gasoline engine that really works. Superpower performance. Smooth, velvety power that roars into action with a "twist of the wrist." Over 25,000 already sold. 1/8 H.P. Complete with coil and condenser. Ready to run, only \$9.95. In KIT form, fully machined, 5 minutes to assemble, \$6.95, without coil and condenser. Powers all models. Fully illustrated instructions. Send \$1.00—shipped collect same day C.O.D. FREE—Send for 24-page illustrated hobby catalog.

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3, 4, 5 H.P. On market nearly a quarter century. No belts. No chains. Warm driven. 2 clutches. Power turning. All tractors guaranteed. Full line of attachments. Buy direct from factory. Write Dept. 102 for free catalogue.

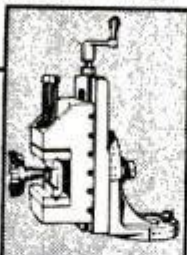
RED E TRACTOR COMPANY RICHFIELD, WISCONSIN

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This Milling and Keyway Cutting Attachment is ideal for shops not having a milling machine. It can be used for milling, boring, keyway cutting and other operations. Mounts on compound rest base of South Bend Lathes.

Lathe Size	Vise Cap.	Price	Lathe Size	Vise Cap.	Price
9"	1-1/2"	\$35	14-1/2"	4"	\$65
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WATER POWER

BAKONTROL gives automatic starting—fast acting governing—automatic stopping—of any hydro plant. Bakontrol hoards water, gives amazing convenience. Pays for itself. Lock up your power house and leave it for weeks, while it continues to deliver power automatically. Tell your friend with water power of this ad. Send now for free 12 page booklet B-1. Bakontrol Mfg. Co. 4867-A HAMILTON CLEVELAND 1, MICH.

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Ride a Royal Enfield



Famous English Lightweight Motorcycle...takes you anywhere

Royal Enfield's popular Model R. E. has everything—Style, Safety, Economy, Flexibility, 125 c. c. 2-stroke, single cylinder engine; 3-speed gears. Goes 100 miles per gallon of gas! 45 m. p. h.! Folder "P" gives you all details. Also 350 c. c. and 500 c. c. models. Dealer inquires given prompt attention.

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Smoky exhaust means oil pumping by worn connecting rod bearings. They let excess oil reach combustion chambers. It burns to carbon — performance sags, costs rise. Restore performance with Federal-Mogul bearings. They are engineered for the job of oil control. Ask your mechanic!

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Oil-Control Bearings

Replace in Sets with Genuine

SAY YOU SAW IT IN POPULAR MECHANICS

Now! YOU CAN INSTALL DUAL WHEELS

On your Trailer, Pick-up Truck, Farm Wagon or Jeep
IN LESS THAN TEN MINUTES

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Complete Set of Castings and
Extension Bolts for 2 Wheels.

Install with a rim-wrench—
easier than changing a tire.
New patent dual wheel con-
verter eliminates entirely
the expense of changing to
truck-type wheels and hub;
no need to change the en-
tire rear axle. Now you can

do the job at a fraction of the old cost. Guarant-
eed satisfaction or money back. Du-All Adapters
are scientifically designed so that load is trans-
ferred from outer wheel by the casting direct to
the hub . . . Absolutely will not damage the wheel
bearing or axles unless overload is carried to
extreme excess . . . Increase traction and increase
tire life with Du-All Adapters. Trailers can carry
up to 50% more.

JEEP WIDE TREAD ADAPTERS

Now you can convert your wheel tread to stand-
ard 58" width. Avoid trouble with ruts on
unpaved roads or driveways with these com-
pletely new type adapters. Set of 4 castings and
20 extension bolts, for all 4 wheels, can be in-
stalled or removed in 15 minutes. Safe. Sturdy.
Simple to install. Only \$36.00, complete set.

16" DROP CENTER WHEELS

For Model T Fords . . . and all old models
with off-standard hubs. Heavy duty, dou-
ble disc wheels to replace all obsolete wood
wheels of odd sizes—for trailers or pas-
senger vehicles. Two Sizes, Two Numbers,
Only \$5.95 ea. WF111N—For Model T
Fords. With all holes drilled, ready to bolt
on. WP400N—Universal Fit with Center
Hole in Blank Disc for drilling to size.

DEALERS: SEND FOR FREE CATALOG.

Northwestern Auto Parts Co., 834 N. 7th St., Mpls. 11, Minn.

CLIP THIS COUPON NOW

Please send me..... FORD CHEV DODGE-PLYM
 INTNTL (1/2 ton, 37 47) JEEP Dual Wheel Converters
at \$28.50 each set. (Ship. Wt. 33 lbs.)
 FORD ('36-39 Psgr. & Lt. Comcl.) Dual Wheel Converters.
Also fits 3/4 ton '38-42 at \$32.50 each set (Ship. Wt. 70 lbs.)
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Address.....

City.....State.....

Northwestern Auto Parts Co., 834 N. 7th St., Mpls. 11, Minn.

DEALERS: Sell DUAL WHEELS. Many fine territories open,

Pacific Sweet Spot

(Continued from page 101)

check on soil conditions, finding the right
fertilizers and weed killers, and—perhaps
most important of all—combatting insect
pests and diseases.

It is in the latter field that they've done
their most spectacular work. Largely be-
cause there is no frost to kill them off,
crop-destroying insects and diseases
abound in such areas as Hawaii. They can
kill a crop overnight once they get a foot-
hold, and on several occasions almost have.

For example, around the turn of the cen-
tury a tiny grasshopper known as the sug-
ar-cane leaf hopper made its way to Ha-
waii from Australia, probably aboard a
ship. Within three years literally billions
of these pests swept across the cane fields
like storm clouds, destroying everything in
their path. The output of one plantation
dropped from 19,000 to 826 tons. The indus-
try's outlook seemed dark indeed.

Experiment station entomologists,
working on the theory that the hopper was
held in check in its native environment by
some natural enemy, went to Australia and
searched the cane fields. They finally found
it—a tiny parasite that laid its eggs in the
hopper's body.

Shipped to Hawaii, the parasite was let
loose in the fields. Almost immediately, the
hoppers began dying off in great numbers.
Later, parasite reinforcements brought in
by the scientists from Fiji, China and For-
mosa completed the rout. Today, you'd
have difficulty finding one hopper in Ha-
waii, outside those in the station's spec-
imen cases.

A few years later the industry was again
threatened with disaster, this time from a
mysterious root disease. The only hope of
salvation appeared to be through the
breeding of a new variety—a virtually un-
known procedure in the sugar industry.
Cane seeds are so microscopically small
that most sugar farmers had forgotten they
existed. New plants are grown from shoots
of mature cane.

Working under almost unbelievable dif-
ficulties, geneticists crossed and re-crossed
cane varieties until they had 5000 new
types under propagation. One of these
proved to be what they were looking for.
Planters conservatively estimated that
this single accomplishment was worth \$50,-
000,000 to the industry.

Only a decade ago the pineapple plan-
tations were confronted with a wilt dis-
ease. There was serious doubt whether the
industry could survive. The institute, then

(Continued to page 276)



32
DRAWER
UNIT
\$4.95

64 DRAWER \$7.95

for home
or shop

THE JIFFY ^{all metal} CABINET

THE HANDY WAY TO KEEP SMALL PARTS, WASHERS,
NAILS, SCREWS, NUTS, BOLTS AT HAND

DRAWER SIZE

1 1/4" DEEP
3" WIDE
6" LONG

CABINET SIZE

32 Drawer Unit
6" DEEP
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15 1/4" HIGH
Shipping Weight
9 lbs.

64 Drawer Unit
6" DEEP
25 1/2" WIDE
15 1/4" HIGH
Shipping Weight
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For small items, the low-cost Jiffy Cabinet, 32 or 64 drawer units that put office, shop, work bench, household and hobbyist needs at your fingertips. Metal flange drawer guides. Spot welded all metal cabinet with sturdy laminated drawers insures long time-saving service. Why fumble? With the Jiffy you know where it is. 32 drawer unit—\$4.95; 64 drawer unit—\$7.95. Send check or money order—No C.O.D.'s please. Ohio orders please add 3% Sales Tax.

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FOR RADIO ANTENNAS, WEATHER
OBSERVATION, AERIAL PHOTOGRAPHY
or JUST PLAIN FUN



Originally made to take up emergency radio antennas, these balloons and kites are beautifully made of the finest materials.

The balloons inflate to approximately 4 feet in diameter and have a lifting capacity of 3 to 5 lbs. They are made of extra heavy rubber and come sealed in metal cans. Each balloon has its own hydrogen generator which works when simply put in water.

The box kite is scientifically designed. Its strong aluminum frame folds up like an umbrella so the kite can be stored in a small space.

A complete kit consisting of 2 Balloons, 2 Generators, 1 Box Kite, all packed in a tubular canvas bag, is priced at only \$9.95. (Cost the Government about \$75.00.) Send your check (or M.O.) for \$9.95 and we will promptly ship your Balloon-Kite Kit via express. Quantity limited.



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Only 10¢
SPECIAL OFFER

● This easy-reading GREENLEE HANDY CALCULATOR swiftly solves your wood-working problems. Just set the dial: convert linear feet to board feet; get slope per foot in degrees; compare hardness, weights, shrinkage, warping and working ease of various woods. More, too: bit sizes for head, body, thread of screws; nail specifications; tool sharpening hints; protractor. 6" diameter, fits your tool kit. Heavily varnished cardboard. Special offer. Order now, send 10¢ (not stamps) in next mail. Greenlee Tool Co., 2102 Columbia Ave., Rockford, Ill.

GREENLEE



WAR! Surplus & other BARGAINS!



Surplus DUST MASKS
33¢

BRAND NEW. Here's a mask that will serve many purposes. Insecticide and paint spraying. Ideal for milling companies. Reg. \$1.50 value



AVIATORS STYLE
24 Karat GOLD RIM
SUN GLASSES
4 BASE CURVE

BRAND NEW The type the aviators used. Genuine 24-karat gold-plated rims, ophthalmic ground, 4-base curve. Eliminates 96% of ULTRA-VIOLET RAY. We sold thousands at twice the price.

288



Genuine NYLON PER HANK
59¢

PARACHUTE CORDS
3/16-in. diameter. Has a tensile strength of 500 lbs. Ideal for clotheslines, venetian blind and drapery cords. Each hank 50 ft. long.



BRAND NEW 17 JEWEL Military Style WATCH

24.95

PLUS 10% FED. TAX

The Greatest Watch Value in the U. S. A. Finest quality 17 jewel precision Swiss movement. DUST PROOF, WATER REPELLENT, SHOCK PROOF, ANTI-MAGNETIC, SWEEP SECOND HAND, Stainless Steel Case. Complete with strap. Be sure to include the 10% federal tax.

Surplus NAVY UNLINED FIELD JACKETS



BRAND NEW. Made of fine quality water-repellent poplin material. Unlined, full zipper front, 2 slash pockets. Here's an ideal utility jacket for all-around wear. Worth twice our price.

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These were designated for reissue. Used, Absolute Perfect Condition. All have been cleaned and pressed by the Q. M. Corp. 100% wool serge. Less than the price of the cheapest overall.

69¢ Navy STYLE "T" SHIRTS



BRAND NEW Made of fine quality long staple cotton yarn. White only. Sizes: small, medium, and large.

SHIRTS SIZES 13 TO 15
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PANTS SIZES 28 TO 33
295

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U. S. Navy Regulation
First Quality
Brand New
Full Cut Sleeves

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Made of 3-oz. green herringbone twill. Tailored to Navy specifications. Ideal utility and work jacket.

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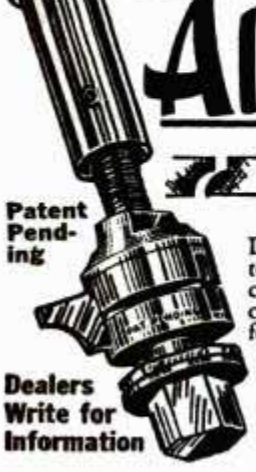
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DeLux Model includes bottom bearing that anchors tool to bottom of press. Regular Model without bearing. Comes complete with adaptor and 6 blades making 12 standard cuts—balance blade—beautiful wood box. Over 100 different, practical cuts can be made with the 6 blades. See your dealer or send check or money order for delivery to your door. All other orders C.O.D. plus postage.

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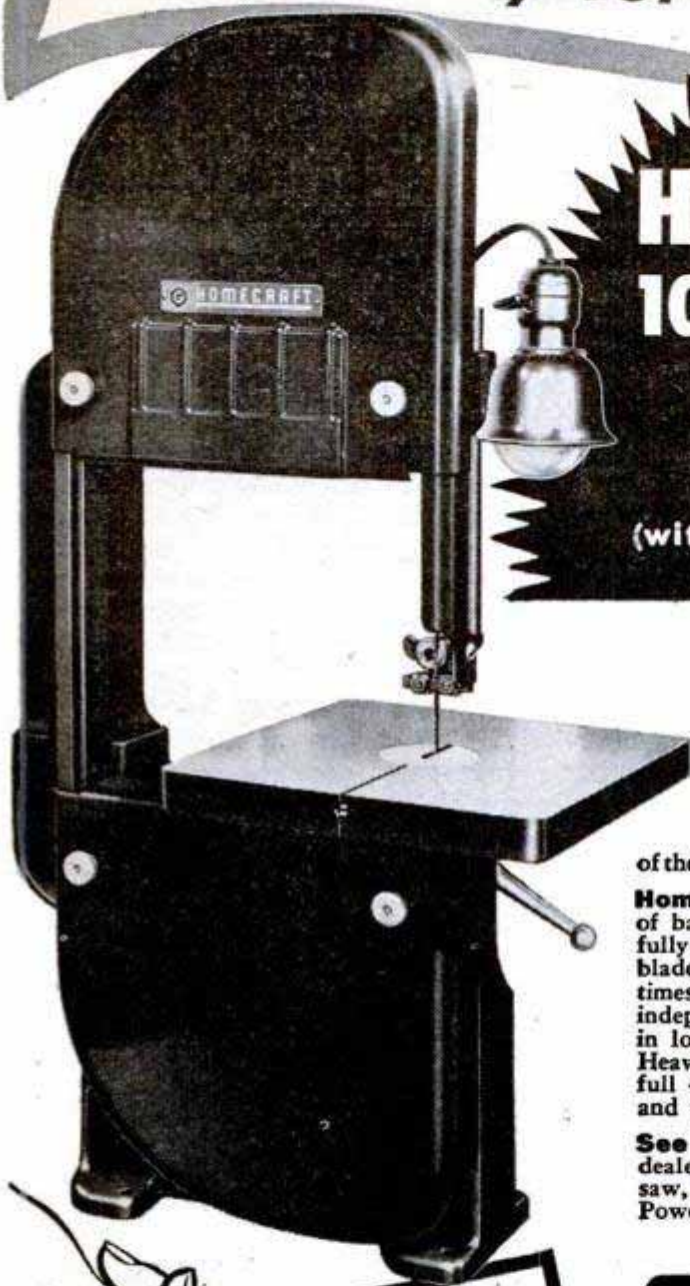
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Makes any cut wood-shaping tools costing up to \$300.00 can make—more too. Sturdily built, lasts a lifetime.

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HOMECRAFT® 10-inch Band Saw

No. 28-110

Only \$36⁹⁵

(without motor or lamp attachment)

A practical hobbyist's band saw that has 6½" capacity under the guide and a throat capacity of 9½"

The 28-110 *Homecraft* Band Saw is an outstanding hobby-shop tool! It fulfills the demand for a good, dependable, popular-priced tool that fits the needs of the average hobbyist who "tinkers" with wood.

Homecraft features like this add up to a lot of band saw for the money: Blade guides are fully adjustable for different sizes and types of blades. Correct tension is kept on blade at all times. Ball-bearing blade support is adjustable independent of blade guides. Bronze bearing in lower wheel; needle bearing in upper wheel. Heavily-ribbed 10" x 10" cast-iron table tilts full 45° for angle-cutting, has convenient scale, and can be securely locked in place.

See It At Your Dealer! Ask your *Homecraft* dealer to show you this No. 28-110 new band saw, and his complete display of *Homecraft* Power Tools priced from \$29.95 to \$39.95.

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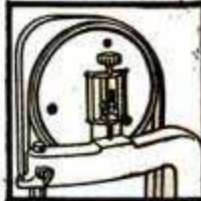
**HOMECRAFT®
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General Sales Office — Chicago 2, Illinois

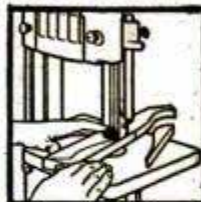
Descriptive Literature! Shows all *Homecraft* Power Tools and accessories. Sent to you free. Use coupon below, to get your copy.



Tilting table locks quickly and securely in place. Convenient scale tells you the angle of tilt.



Wheel-tension and blade-tracking adjustments provide handy means of aligning blade and keeping correct tension at all times.



For safety, protection is provided by front blade guard which adjusts up and down with blade guides and ball-bearing blade support.

HOMECRAFT POWER TOOLS

are built by the makers of the famous Delta-Milwaukee Power and Machine Tools, the acknowledged leaders in accuracy, safety, and dependability. Thousands of Delta tools are used today in industry, in schools, and in home shops too. So, if your goal is the finest shop obtainable, equipped with high-quality power tools that embody the very finest principles of engineering, design, and construction, then insist on Delta-Milwaukee Power Tools. *Trade Mark Reg. U.S. Pat. Off.

HM-56

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Rockwell Manufacturing Company
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Please send descriptive literature on *Homecraft* Power Tools.

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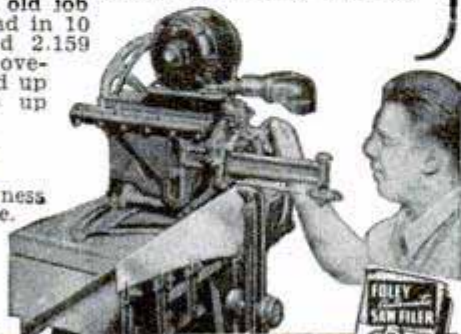
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MAKE A GOOD LIVING IN YOUR OWN BUSINESS—sharpening saws with the Foley Automatic Saw Filer. It makes old saws cut like new again. All hand saws, also band saws and cross-cut circular saws can be filed on this ONE machine.

THERE ARE HUNDREDS OF SAWS TO BE FILED in your own neighborhood, used by farmers, carpenters, homes, schools, factories, etc. W. L. Tarrant writes: "I left my old job last September and in 10 months have filed 2,159 saws. We have a lovely business worked up and cannot keep up with the work."

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**NEW GEOMETRY:
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EASIER TO OPEN**

New Thin-Nose VISE-GRIP wrench has new Involute Jaw Curve, Knurled Jaw Tips and powerful Wire-Cutter. It's the world's most complete hand tool!

Locks to the work with Ton-Grip. Holds anything, any shape, with non-slip grip. Easy to open. Adjusts to ratchet action. Fine alloy steel.

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With cutter 7" \$2.25; 10" \$2.50
Without cutter 7" \$1.85; 10" \$2.25

PETERSEN MFG. CO., Dept. M-2, DeWitt, Nebr.

in its infancy, set to work and discovered it was caused by an insect called the mealy bug which secreted a toxin. This bug, incidentally, seems to have some strange alliance with the ant. The ant constantly attends it, moves it from plant to plant, and protects it from its natural enemies. The pest was brought under control by measures developed by the scientists.

Both industries are constantly expanding their programs of scientific research. It costs the sugar planters alone more than \$1,000,000 to maintain the experiment station, but they feel it is well worth it.

The Burned-Nose Club

(Continued from page 111)

Assured that they will not be burned to a crisp, they are started out in temperatures of 100 degrees—not much more than a hot day at Coney Island. Next time they are jumped to 140 degrees—about like standing out-of-doors in the midday sun in Death Valley. In succeeding experiments temperatures go on up to 180, 220 and 260 degrees. Each succeeding time, the experimenters are better able to "take it."

The body is almost as effective in overcoming severe heat conditions around it as it is in combating severe cold. Through the mechanism of the sweat glands and other cooling processes, the human body strives to create around itself a cool "envelope" of air that is substantially lower than the rest of the air in the hot box.

For example, here are thermocouple temperatures recorded, toward the end of the experiment, at various places on the body when the hot-box air registered 220 degrees:

Forehead.....	101
Chest.....	101
Back.....	102
Abdomen.....	101
Upper arm.....	99½
Forearm.....	100
Thigh.....	104½
Calf.....	105

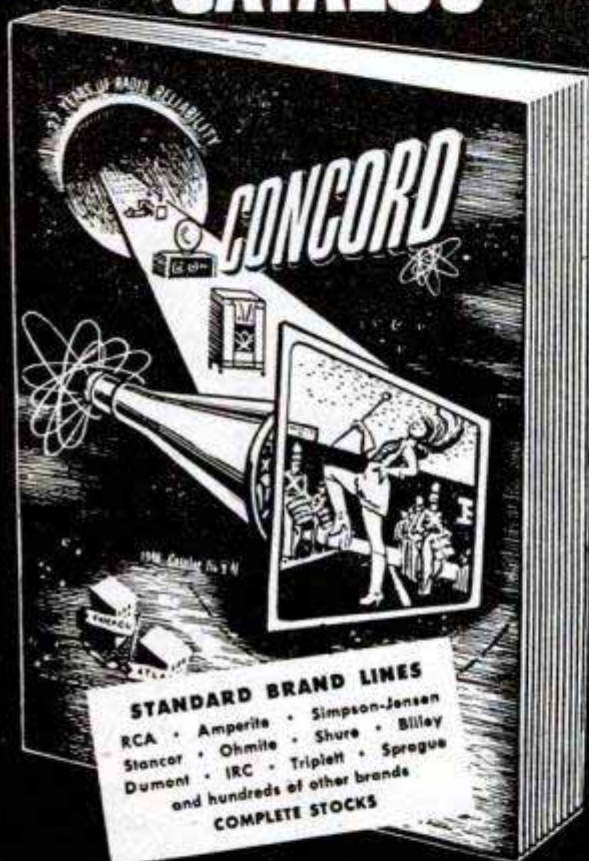
In this same experiment, rectal temperatures, taken to record body temperature, in general never went higher than about 100 degrees. Normal is 98.6 degrees.

It was thought at first that the eye, being perhaps the most delicately adjusted and constructed organ in the body, would probably suffer most under conditions of extreme heat. What the researchers underestimated was the eye's own cooling system of tears. Delicate thermocouples of #40 copper and constantan wire were

(Continued to page 280)

Free

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**LOWEST PRICES on Everything in
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- Thousands of items—parts, supplies and equipment—for every Radio and Electronic need.
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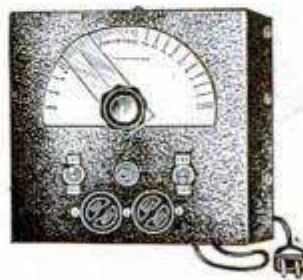
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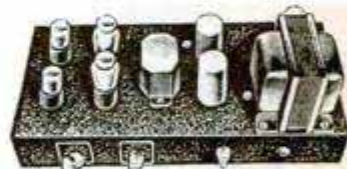
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Lafayette Radio Corp.

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of Great Money-Saving
Buys in this 160-Page
Radio Catalog!*



ELECTRONIC Photo-Print Timer

Time range from 1 to 60 seconds. Will control any electric appliance or lamp that does not draw more than 250 watts. The relay coil is in series with the plate circuit of the triodes-connected portion of a 117L7-GT tube. After a warm-up period, the tube conducts through the relay coil and closes the relay. Enlarged blueprint of all layout and wiring diagrams complete in every detail is furnished. Popular Mechanics No. R-339. Less tube. Shp. wt. **\$767**
6 lbs. C24518.....



10-WATT AMPLIFIER

Wherever a good ten watt audio amplifier with negligible distortion is desired this conservatively rated unit "fills the bill." An exceptional bass reproduction method eliminates booming unnatural tones. The output stage is resistance coupled with a pair of 6A3 type tubes in push-pull being used. Circuit includes a phase inverter and a simple form of feed-back that prevents distortion and reduces hum level. Tubes employed: 6C5, 6N7, two 6A3, 5U4G. Kit complete less 10 inch PM speaker and tubes. Shpg. wt. 24 lbs. Popular Mechanics R331. **\$1995**
C24512.....



EVEN-SPEED PHONO-MOTOR

Model 80. Rim-drive phono motor. 9" turntable. Constant speed (78 r.p.m.) self-starting, forced draft air-cooled. For 10" and 12" records. 110 V. 60 cycles only. Wt. 4 lbs. **\$269**
X182.....



5-TUBE AC-DC KIT

Five-tube AC-DC superheterodyne. Includes automatic volume control, true tone reproduction. Streamlined airplane dial, wide tuning that covers 550 to 1600 KC, built in loop antenna and Alnico V speaker. Cabinet is beautiful brown plastic. Kit contains all parts to build complete receiver. C24456—With cabinet and tubes..... **\$1375**



CRYSTAL PICKUP

Quality crystal pickup mounted in arm for 10" and 12" records. Mounting included. Requires 1/2" hole. Shielded lead and cartridge case. Aluminum die cast arm finished in smooth dark brown. With semi-permanent needle. **\$159**
X143.....

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Yes, rush FREE COPY of the comprehensive new Concord Radio Catalog.

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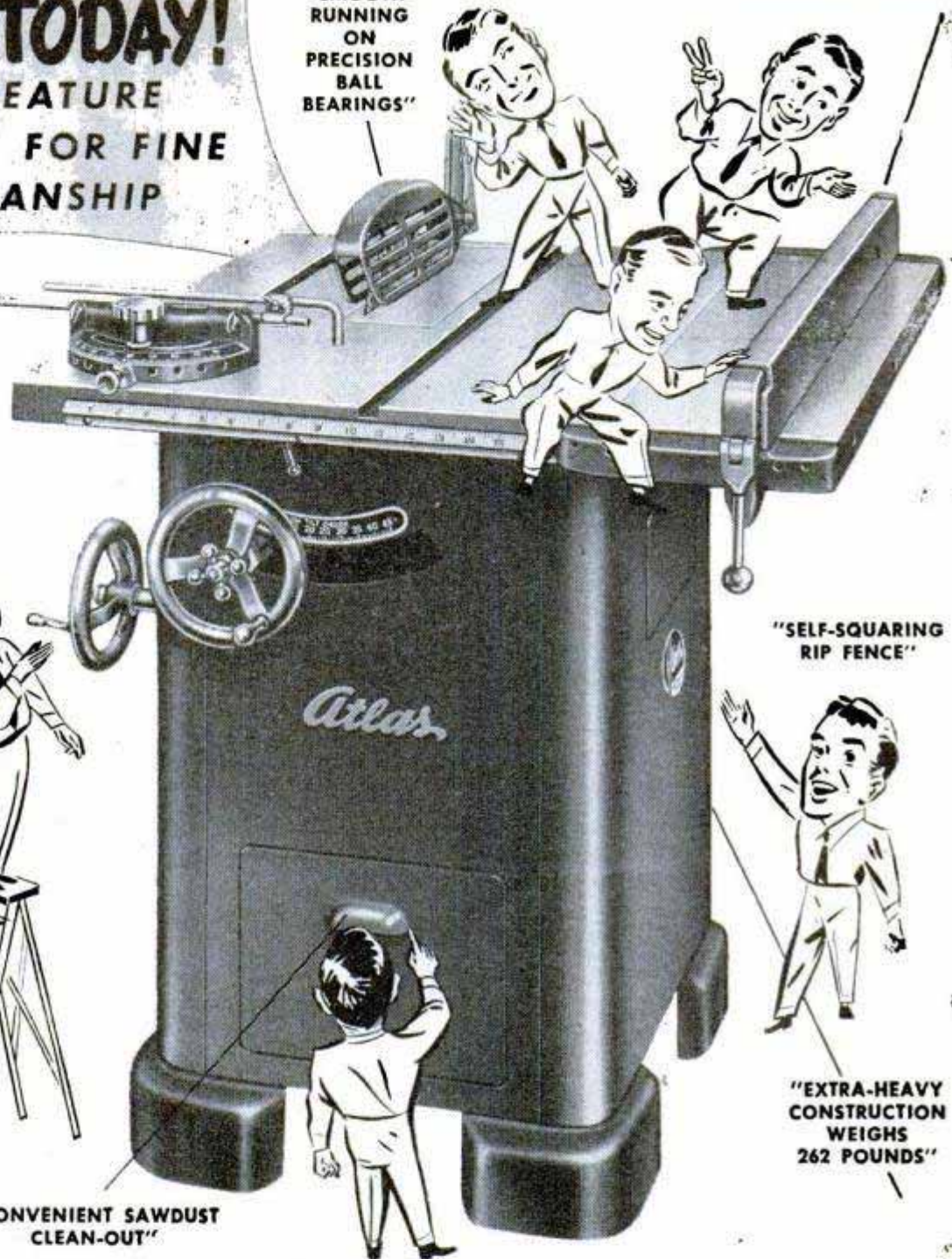
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 243 N. Pitcher St., Kalamazoo 13D, Mich.

Please send me free illustrated bulletin on the
 new Atlas 10" Tilt/Arbor Floor Saw.

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City _____ State _____

CHECK THIS NEW ATLAS SAW — inside and out — see everything *you* would specify in a made-to-order machine! It's a natural for cabinet makers, builders, lumber yards, manufacturers, and home workshops . . . built with metal-working tool precision for easier, *more accurate* sawing . . . with ruggedness to stand the gaff of steady, heavy-duty work. Examine its big table: 27½" x 27½", with 13¼" working surface ahead of the blade. Note the precision ball bearings for *permanent smoothness*. Go over the new-type rip fence — *self-squaring*, locks rigidly at both ends, *releases instantly* for positioning or removal — nothing else like it! This new Atlas is the last word in saw engineering — built for years of dependable service. Ask your Atlas distributor, or send for illustrated bulletin.



ATLAS PRESS CO.

243 N. Pitcher St. • Kalamazoo 13D, Michigan

Paint Your Own Car in *One Hour* with the **NEW AUTO ENAMEL**

YOU WIPE ON Like Magic with only a **POWDER PUFF**

LUSTR-WIPE

2 YEAR
Guarantee

TRADE MARK

Dries in about one hour to smooth, mirror-like professional finish.

GUARANTEED FOR 2 YEARS not to crack, chip, peel or fade, if simple directions are followed. Lustr-Wipe is NOT a wax or a polish but a marvelous new Auto Enamel.



NO Brushing
NO Spraying
NO Masking
NO Streaks

Just follow the simple instructions and LUSTR-WIPE will give your car that new "factory-look." No Streaks! No Lap-marks! Dries dust-free in about an hour! Goes over any other color, enamel or lacquer.

ONE QUART PAINTS YOUR ENTIRE CAR ANYONE CAN DO A BEAUTIFUL JOB

LUSTR-WIPE is the easy, speedy, economical, yet most successful way you've ever seen to PAINT YOUR OWN CAR. It's different-works almost like magic! All you need is ONE QUART of LUSTR-WIPE, the Miracle Auto Enamel, and the powder puff we send you AT NO EXTRA COST. Almost ANYONE, can do a magnificent job in about ONE SHORT HOUR. It seems unbelievable but true. JUST WIPE IT ON. No brush needed. No spray required. No masking of any kind. LUSTR-WIPE dries dust-free in about an hour. You'll be amazed—thrilled beyond words with the results! Your friends will think you spent \$75 to \$125 for a professional paint job. YOUR CAR WILL LOOK "LIKE NEW". Rush your order for a quart of LUSTR-WIPE TODAY.

WHICH OF THESE 10 COLORS DO YOU LIKE?

BLACK \$3.95 Qt. **Brewster GREEN (dark)** \$3.95 Qt.
MAROON \$3.95 Qt. **Jewel GREEN (light)** \$3.95 Qt.
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Monticello BLUE (light) \$3.95 Qt. **Air Wing Grey (light)** \$3.95 Qt.
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MAIL COUPON TODAY! SEND NO MONEY!

AGENTS WANTED FOR NEW MONEY-MAKING BUSINESS! CAN MAKE GROSS PROFITS UP TO \$275.00 IN ONE WEEK.

Go into business for yourself selling LUSTR-WIPE in cans, or painting cars yourself or having others to do the work. Owners of old cars everywhere (who can't get new cars) are easy prospects. Send now for our MONEY-MAKING PLAN.

DISTRIBUTORS WANTED: A few wonderful territories now available. Write at once for our SPECIAL OFFER. LUSTR-WIPE CORP. 166 W. Washington St. Dept. 2, Chicago 2, Ill.

This Price for Immediate Delivery

SAVE by
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ORDER ONE
OR MORE
QUARTS TODAY

\$3.95
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Applicator
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LUSTR-WIPE CORP. 166 W. Washington, Dept. 2, Chicago 2, Ill.

Please send me _____ quarts of LUSTR-WIPE AUTO ENAMEL at the special price of \$3.95 per quart.

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Send Postpaid. Full Payment \$_____ enclosed.

Send C.O.D. plus Postal charges.

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CITY _____

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Send information regarding AGENT PLAN.

Send information regarding DISTRIBUTORSHIP.



MOTO-SAW

THE AMAZING ELECTRIC SCROLL SAW

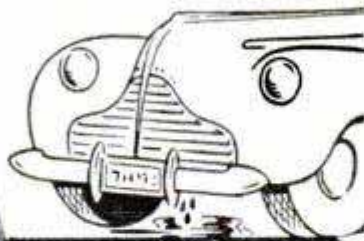
Boys from 8 to 80 (and girls, too) have fun with a Moto-Saw . . . it works more like magic than any tool you ever saw! It takes no effort to run, no perceptible pressure to feed. Runs 7,200 strokes a minute . . . easily cuts intricate scroll designs in medium hard wood up to 3/4" thick. Blade holder faces blade 4 ways . . . permits you to saw sideways as well as forward and backward. No limit to length of stock it will cut . . . saws to center of 19" widths. **Moto-Saw is as safe as a hand saw . . . has only two moving parts . . . never needs oiling.** Uses 110-120 V. 50 or 60 cycle A.C. (only). Thousands of satisfied users.

MONEY-BACK GUARANTEE: If your dealer does not yet have Moto-Saw, send only \$5.85 . . . we'll pay postage. Or send \$1, and pay postman balance plus postage. Money back if not delighted after 5 days' trial.

DREMEL MFG. CO., DEPT. S-118-B, RACINE, WIS.



STOP LEAKS!



**Cooling Systems
Made Leak-Proof QUICKLY**

WARNER LIQUID SOLDER—Non-Metallic—Deposits Tiny Fibers to Repair Leaks Anywhere in Cooling Systems. Simply pour in! Finds and REPAIRS every crack or hole. Do it yourself—or see your service man.

Warner-Patterson Co., 920 S. Michigan Ave., Chicago 5

placed carefully against the eyeball after it had been partially anesthetized. At 180 degrees inside the heat chamber, the contact temperature of the eyeball remained at 107.9 degrees.

Even in inhaling and exhaling, through nose and mouth, it was discovered that the body's cooling system was at work substantially lowering excessive temperatures. At 220 degrees inside the hot box, air drawn past the lips measured only 190 degrees and when it got to the back of the mouth it was only 140 degrees. Exhaled air measured about 108 degrees at the back of the mouth and 110 degrees at the lips.

In general, those parts of the body which are injured first by extreme cold were affected first by extreme heat—tips of noses, ears, fingers and toes. At the highest temperature recorded to date—262 degrees—Dr. Craig Taylor's nose was slightly scorched around the delicate membranes of the nostrils. He was promptly elected a member of "The Burned-Nose Club."

In addition to skin and body temperatures, such factors as the humidity of the air, the loss of moisture through sweating, the increase in pulse rate, and the general condition after removal from the hot box were observed.

The heated air was kept at low humidity and this partially explained why researchers were able to stay in the oven for a matter of minutes. The experimenters found that they couldn't use a standard wet-bulb thermometer—the water dried up too rapidly in the high temperatures.

The experiments proved that human respiration can function for some time under extreme temperatures without ill effects. Sweating in all cases was heavy and increased as the temperature rose. For example, at 100 degrees Fahrenheit, the loss of weight (representing sweat loss) was estimated to be 145 grams per hour, while at 220 degrees the loss had increased to 2125 grams per hour.

An increase in pulse rate at all temperatures was noted. At 220 degrees, for example, it rose from 68 to 132—almost twice normal.

After hot-box sessions, the subjects reported a variety of experiences. One felt extreme suffocation. Another reported a dulled sense of hearing and sight. A third experienced nausea. When taken from the heat chamber and cold towels applied to faces and necks, all recovered quickly. In most cases, however, a feeling of fatigue lingered the rest of the day.

But the effects weren't lasting or serious. Twenty-four hours after he had set a

(Continued to page 284)



QUALITY

TABLE MODEL TILT-ARBOR SAWS

OIL IMPREGNATED BRONZE BEARINGS OR DOUBLE SHIELDED BALL BEARINGS, BOTH WITH THE PATENTED BALL BEARING TRANS-AXIAL MOTOR DRIVE

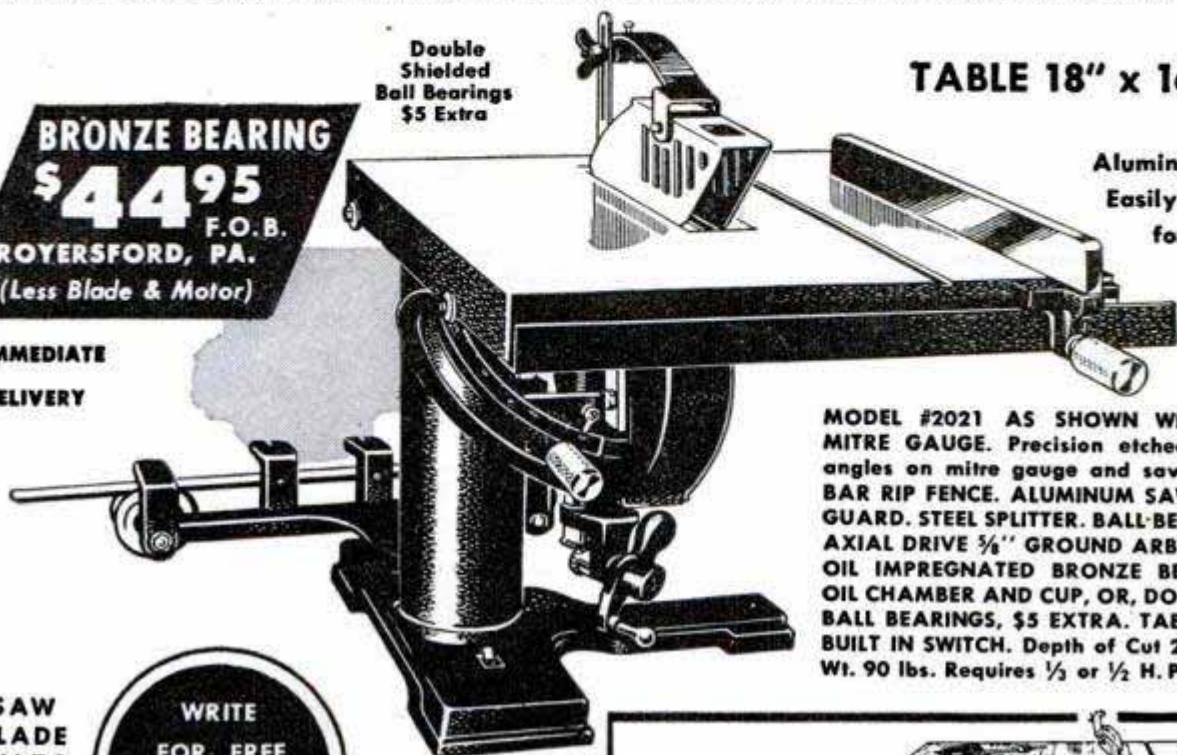
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\$4495
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Double
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\$5 Extra

TABLE 18" x 16"

Aluminum Guard
Easily Removed
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MODEL #2021 AS SHOWN WITH COMPLETE MITRE GAUGE. Precision etched scales show angles on mitre gauge and saw cradle. STEEL BAR RIP FENCE. ALUMINUM SAW INSERT AND GUARD. STEEL SPLITTER. BALL-BEARING TRANS-AXIAL DRIVE 3/4" GROUND ARBOR. "COMPO" OIL IMPREGNATED BRONZE BEARINGS WITH OIL CHAMBER AND CUP, OR, DOUBLE SHIELDED BALL BEARINGS, \$5 EXTRA. TABLE 18" x 16". BUILT IN SWITCH. Depth of Cut 2 5/16". Shipping Wt. 90 lbs. Requires 1/2 or 1/2 H. P. Motor.

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STAYS
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37 1/2"

**BALL
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Royersford, Pa.
(Less Blade
& Motor)

Table 18" x 32" including 18" x 16" extension. Additional extension available to increase table size to 18" x 48".

Complete as shown including Arbor with Double Shielded Ball Bearings and Trans-axial Ball Bearing Drive.

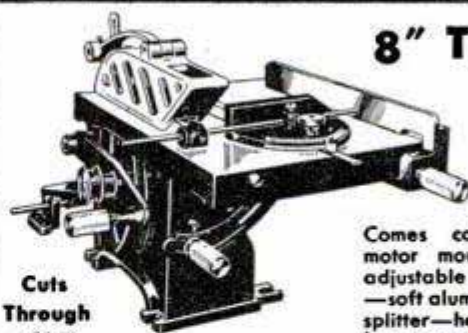
Model #2021
With 2 Extensions
Makes Table 18" x 48"



TABLES PRE-DRILLED FOR EXTENSIONS



EXTENSION
MAKES TABLE
18" x 32"



8" TILT TABLE BENCH SAW

Cuts
Through
2 5/16"

Comes complete with Floating motor mount—mitre gauge with adjustable stop—aluminum guard—soft aluminum insert—spring steel splitter—heavy gray iron fence—(no motor—no blade).

Table 12" x 14" Tilts to 45°—Oilite bearings. Shipping Wt. 50 lbs.

\$2495
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BALL BEARING STEEL WHEELS

Complete with GOODYEAR, GATES or OSBORN PUNCTUREPROOF Semi-Pneumatic Tires . . . Also Solid and Pneumatic Tires . . . FUN . . . SPEED GALORE . . . BUILD YOUR OWN RACER, ETC.

Made To Outwear Other Type Wheels

SIZE	TIRE	BEARINGS	LOAD	ONE	TWO	FOUR
12" x 2 1/2"	Semi-Pneumatic	Ball 1/2" or 3/8"	150 Lbs.	\$ 5.50	\$10.00	\$18.00
10" x 1 3/4"	Semi-Pneumatic	Ball 1/2" or 3/8"	125 Lbs.	\$ 3.00	\$ 5.50	\$10.00
10" x 2 1/2"	Semi-Pneumatic	Ball 5/8"	250 Lbs.	\$ 5.50	\$10.00	\$18.00
20" x 1 3/4"	Semi-Pneumatic	Ball 7/16"	60 Lbs.	\$ 5.00	\$ 9.50	\$18.00
<small>(the above 20" is Bike type 20 Spokes)</small>						
6" x 1 5/8"	Solid	Ball 3/4"	480 Lbs.	\$ 7.85	—	—
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4.00" x 8"	Pneumatic	T. R. 1"	700 Lbs.	\$13.50	\$26.00	\$50.00

(the above 4.00 x 8 is 4 Ply Goodyear with Tube and Taper Roller Bearings for 1 inch diameter straight axle.)
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CHASSIS as shown less power plant, ONLY \$56.00
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These motors also furnished in 3450 R.P.M. at above prices. Prices are F.O.B. Chicago. Immediate delivery. Send check or money order today. **SOLD ON MONEY BACK GUARANTEE.**

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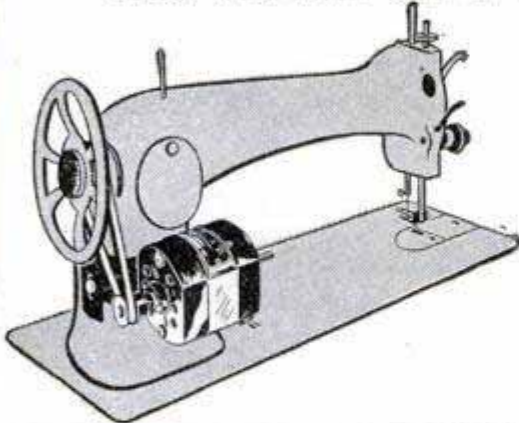
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FILES FOR EVERY PURPOSE**

250-degree record, Dr. Taylor boarded a plane for Dayton, Ohio, made a hasty report to the Army and flew back to Los Angeles—getting but two full nights of sleep in four and not suffering noticeably.

The UCLA research team believes that heavy clothing will give protection against extreme heat in the same manner that it protects against extreme cold. They plan to follow this line of investigation in the near future.

At present their goal is to find the one organ of the body or particular skin area that will yield "critical temperature" information. In other words, if they could find one particular place in the human body that would indicate the limit of endurance, it would be relatively easy to devise an instrument to give a warning signal before such a temperature had been reached. It may be the eyeball, it may be the inside of the nose, it may be the back of the foot. Whatever it is, it has not yet been recognized as such.

Meanwhile the hot-box experiments are continuing. What the final record may be is not known, but the next series of experiments is aimed at 300 degrees.

Dr. Taylor once heard of a German who said he had withstood a temperature of 450 degrees in Nazi experiments during World War II. He was heavily clothed and remained inside the heat chamber only three minutes.

But the idea is intriguing and the UCLA engineering professor and his associates wonder if they'll ever be able to get up to 450 degrees. Such is the curiosity of scientists who produce the marvels of this modern age.

Atomic Explosions in Your Body

Approximately 150,000 radioactive carbon atoms explode every minute in every human, releasing energy equivalent to 21 billion electron volts, according to a new theory. Dr. Aristide V. Grosse of the Houdry Process Corporation at Marcus Hook, Pa., made the statement recently when he announced that cosmic rays produce radioactive carbon. Plants absorb carbon, he explained, by the chemical photosynthesis process of using sunlight. Additional carbon falls to the earth, according to Dr. Grosse, to be picked up by plants. Animals eat the plants, and man eats both the animals and the plants to acquire carbon. Dr. Grosse believes his theory will prompt a re-examination of the effects of radioactivity on the body, possible causes of cancer, and whether atom bombs are likely to cause as serious hereditary changes as some scientists have predicted.

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BRAND NEW ARMY AIR FORCE

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New B29 navigation instrument which can easily be used to make a good contact printer, strip map holder, etc. The plywood case 14 1/2"x11"x10" high is perfect as a tool kit, camera, projector case or for building a portable phonograph picnic kit, make up case, etc., has leather handle reinforced covers, 8 covered compartments in bottom. Cost Gov't \$125.00. Add postage for 20 lbs.

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HEATHKIT TRANSMITTER KIT

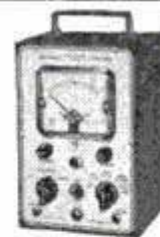
Complete kit for building a fine amateur transmitter includes every part—tubes, cabinet, 80 meter coil, crystal, blueprints and instructions, less power supply. Add postage for 30 lbs.

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HEATHKIT VACUUM TUBE VOLTMETER KIT

Build yourself this beautiful Electronic AC and DC voltmeter and ohmmeter ranges 3 volts to 1000 volts and to 1000 megohms. Every part supplied including blueprints. Add postage for 8 lbs. **\$24.50**



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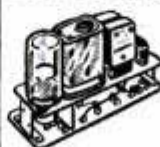
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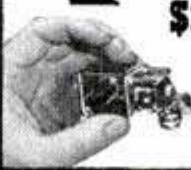
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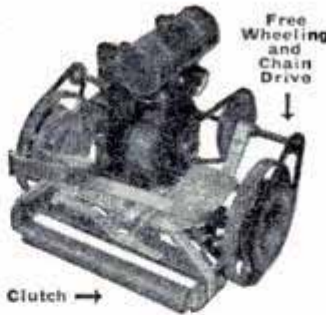
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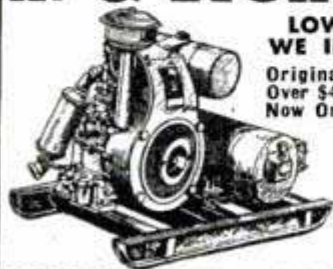
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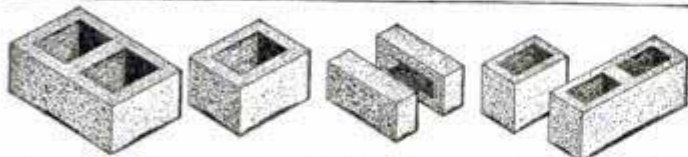
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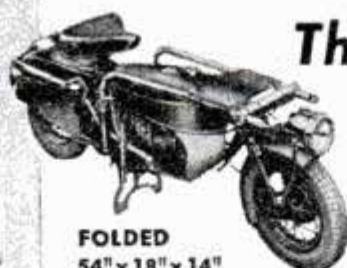
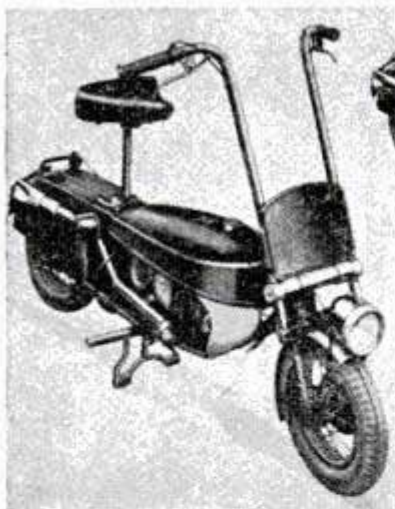
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New STEEL ADJUSTABLE BRACKETS & STANDARDS For HEAVY DUTY SHELVING



Locks in Place—

Easy to Raise or Lower

JIFFY STANDARDS and BRACKETS give every store, garage, factory, work-shop, home-owner and all others solid, easily adjusted shelving. JIFFY BRACKETS can be easily raised or lowered 1½" variation. They're all steel, engineered for strength, give strongest support required by heaviest load.

Anybody Can Install Jiffy Standards and Brackets

Standards are bolted or screwed into wall vertically. Brackets readily slide into place and are safely locked by patented principles. Rearrangement of shelving requires very few minutes. You can build mass displays for stores in a Jiffy. Homeowners will find this the neatest, easiest to install shelving available. Inexpensive—will last a lifetime. No special tools required for installation.



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You can earn big profits installing JIFFY EQUIPMENT in your neighborhood, spare or full time. Write for free literature giving complete details and prices.

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SAVE ON Surplus Bargains

PERFECT ALL WOOL SLEEPING BAG

OLIVE DRAB

Handy for fishing trips, hunting, camping, boating, just roughing it or use as auto robe and many other purposes. Warmth of 2 blankets; zipper slide fastener; tie-strap on bottom; approx. Gov't cost \$12.00. Our Price each... **\$3.95**

Outside Cover for Sleeping Bag—Water repellent... **\$2.39**
PUP TENTS Perfect—2 man size for scouting, camping, etc. Without Pole... **\$2.95**

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Our Sale Price... **\$19.75**

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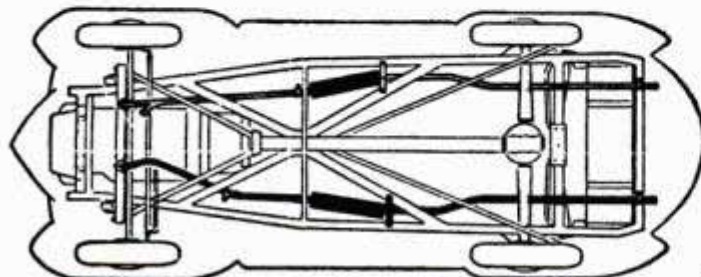
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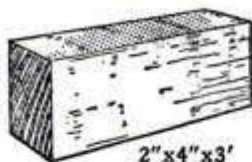
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Shoots:

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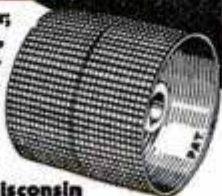
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Please ship _____ Precise Adding Machines at \$17.50 each.
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**GOVERNMENT PAID \$15,000
FOR COMPLETE UNIT
Portable Power Plant**

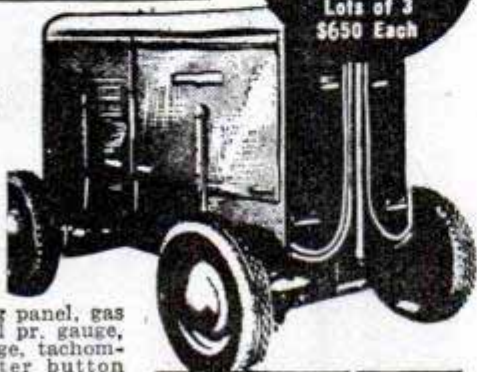
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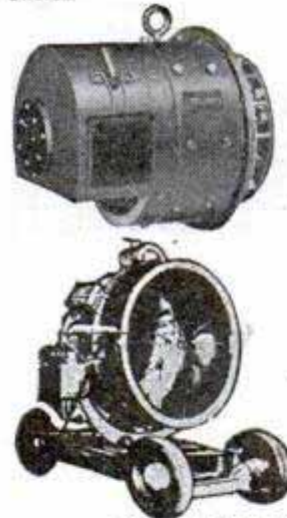
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¾ HP fan motor —
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Complete operating panel, gas gauge, ammeter oil pr. gauge, temperature gauge, tachometer. Choke starter button throttle — 115V plug — 115V switch — Fan switch, winter, summer—Ignition switch—6V plug—Voltmeter—115V Amp-meter—300 A-rheostat—Main switch



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**800 MILLION CANDLE
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Complete with remote
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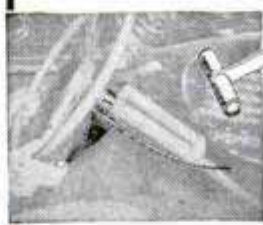
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Every Driver Needs...



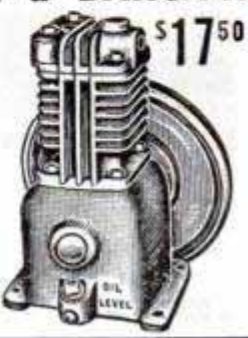
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DRIVE RELAXED! . . . install HANDE-FEED on your car and **MINIMIZE DRIVING FATIGUE!** Installed in about 15 minutes on most cars. Connects directly to carburetor. **RELIEVES AND RELAXES THE FOOT.** Minimizes back-roll on up-hill starts. Simply lift lever to increase engine speed, when released engine idles. Pivots for use with right or left hand. Does not interfere with gear shift or steering. All chrome finish. Complete instructions with every unit. **\$4.95 postpaid.** Send check or money order.

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PRICE **\$16.50**
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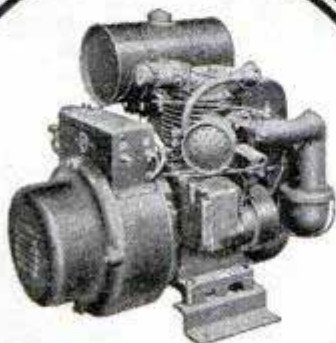
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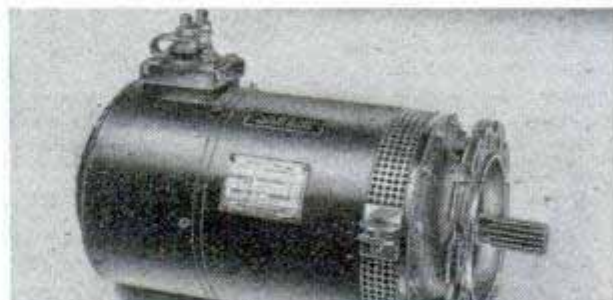
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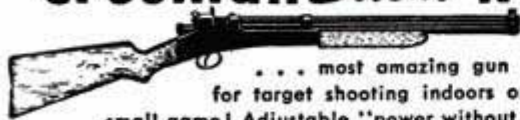
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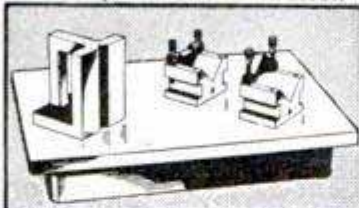


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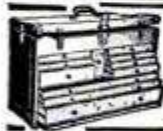
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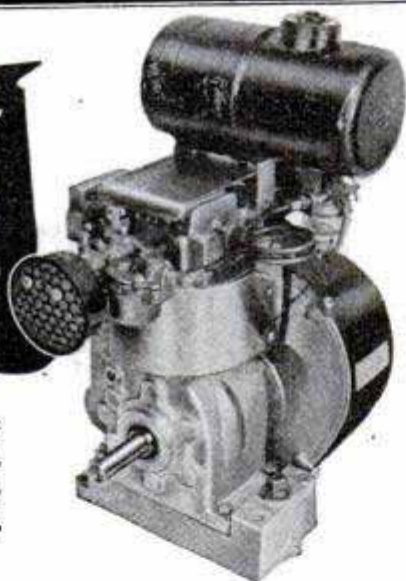
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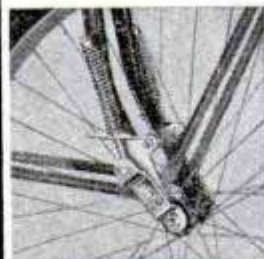
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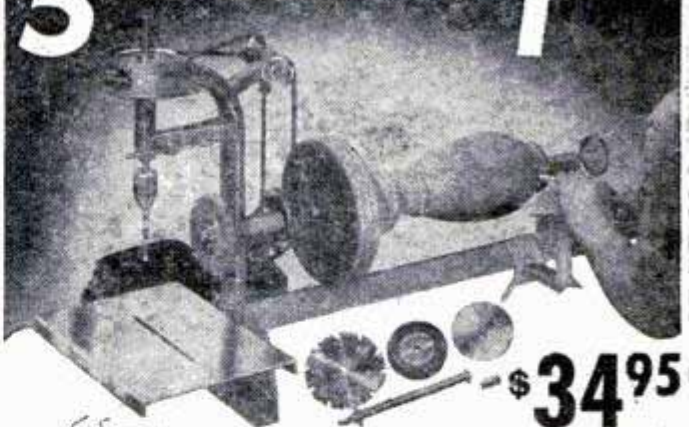
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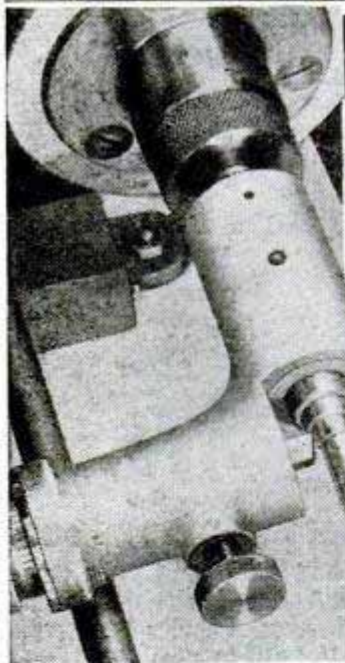
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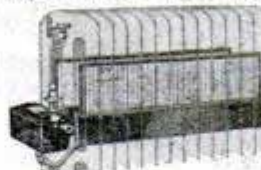
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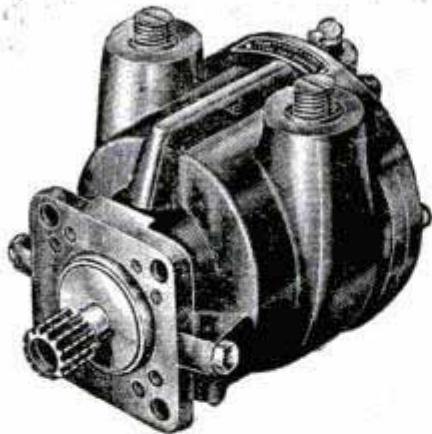


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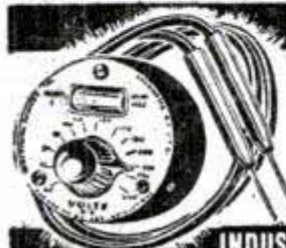
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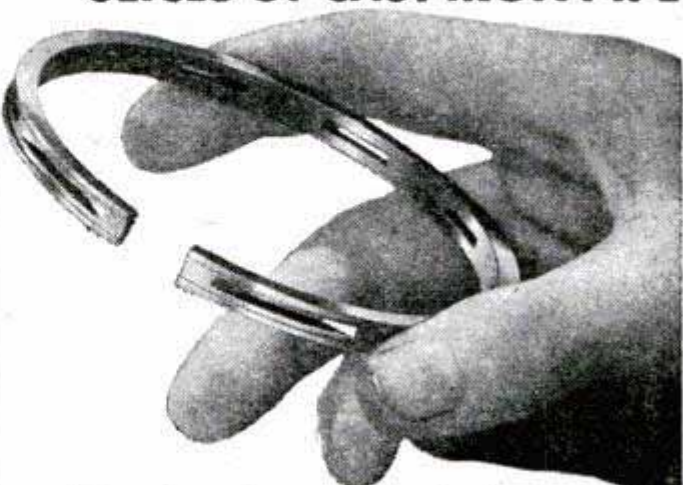
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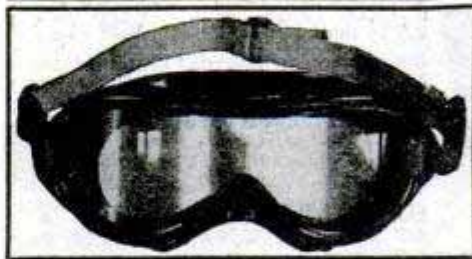
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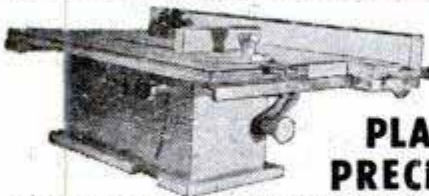
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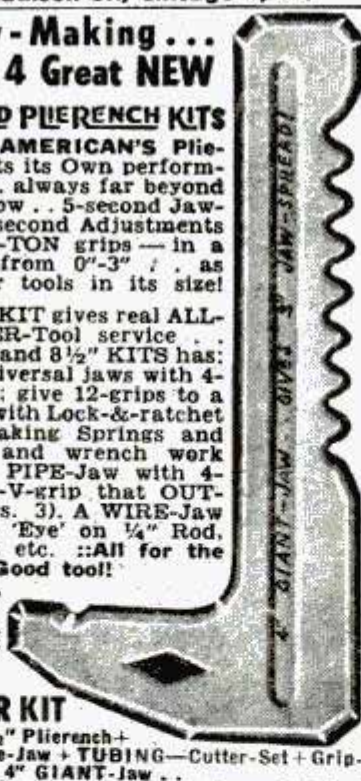
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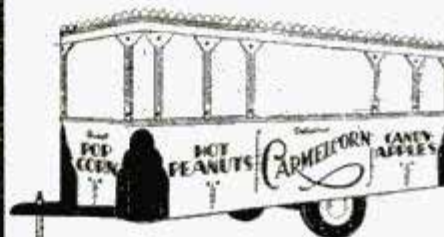
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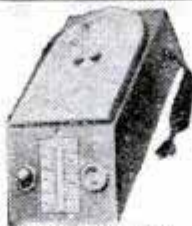
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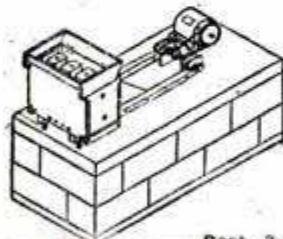
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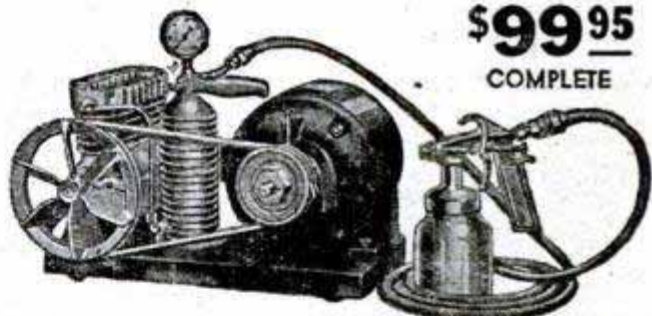


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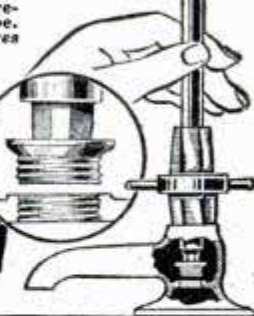
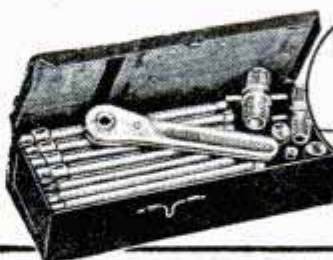
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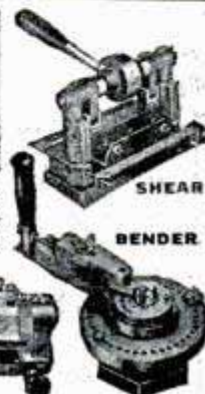
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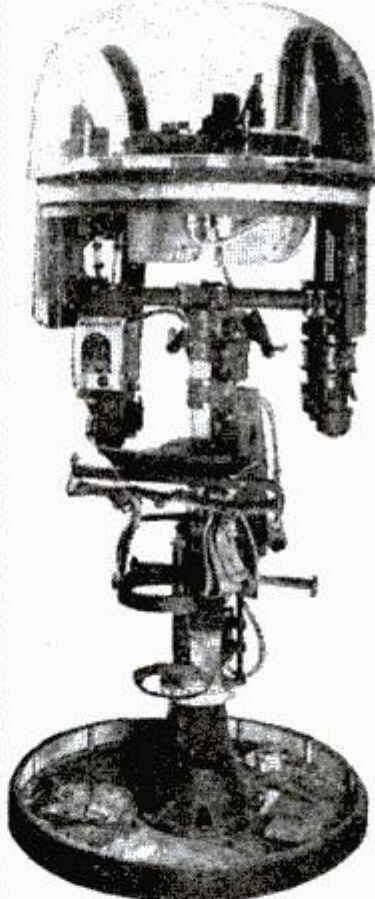


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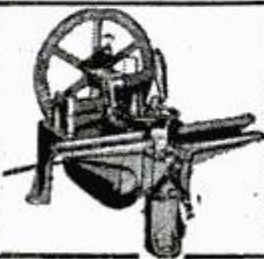
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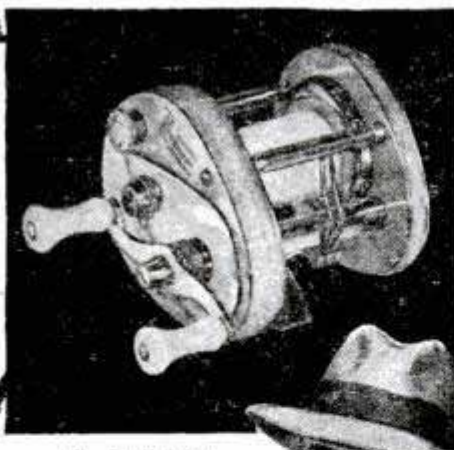
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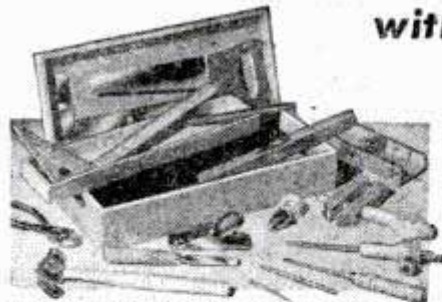
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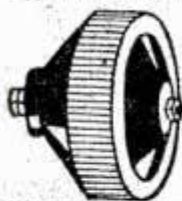


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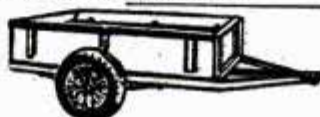
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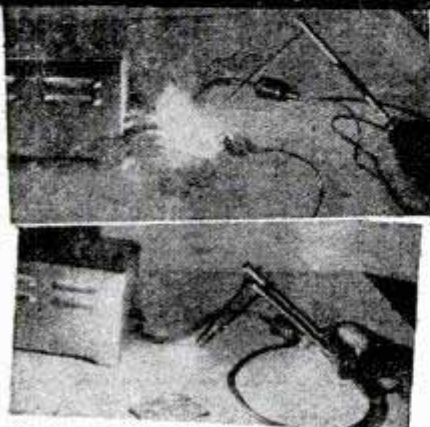
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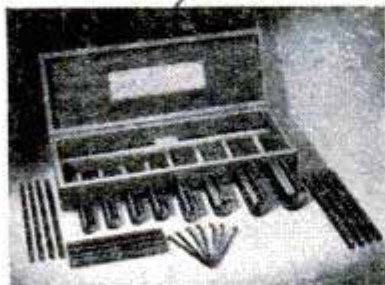
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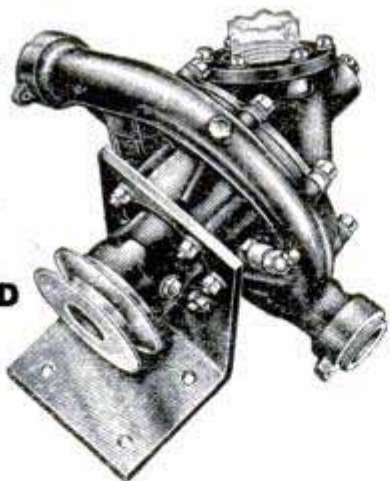
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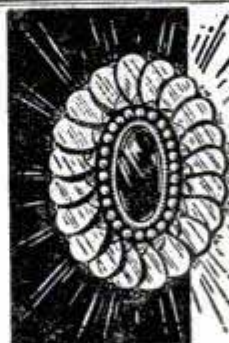
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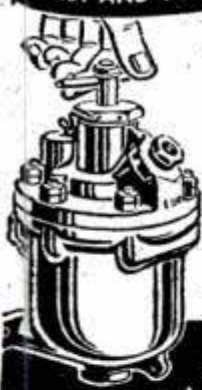
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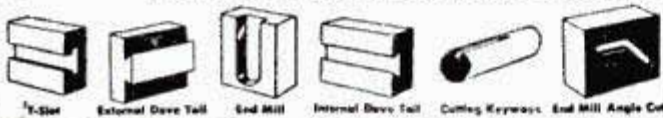
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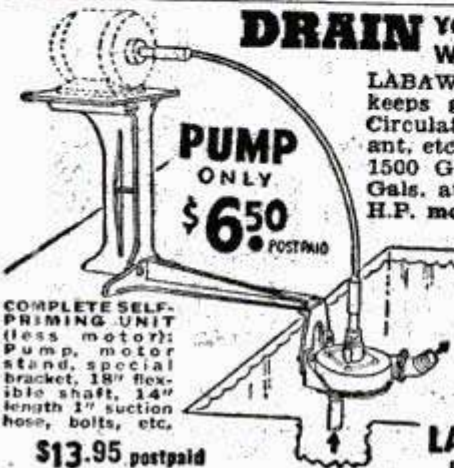
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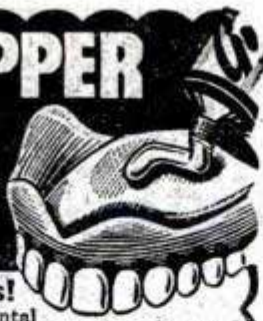
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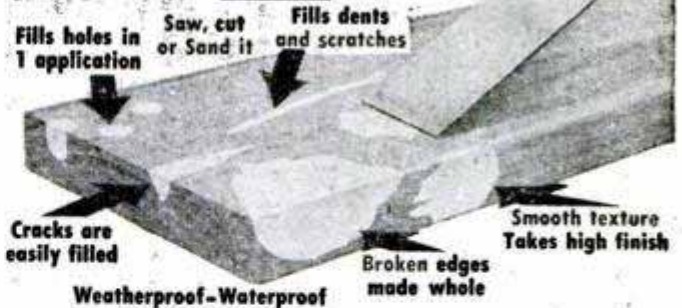
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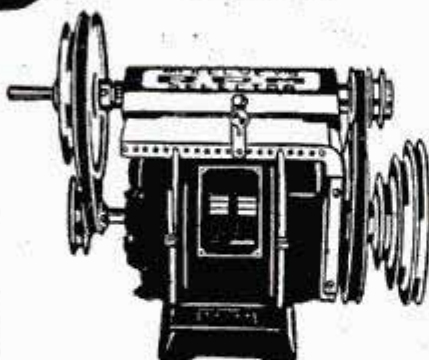
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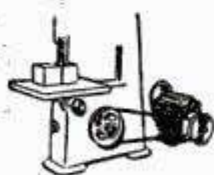
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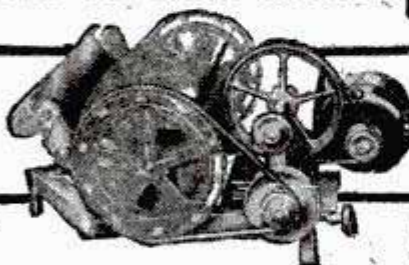
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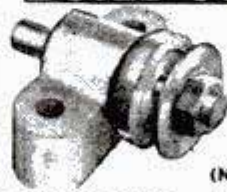
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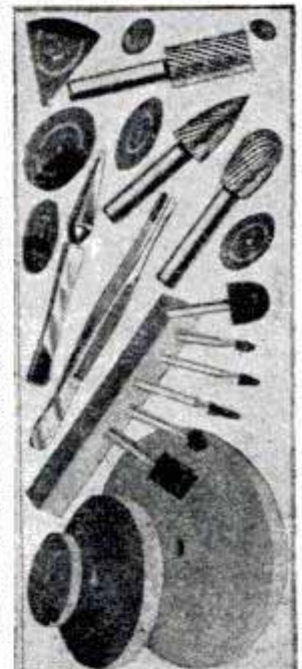
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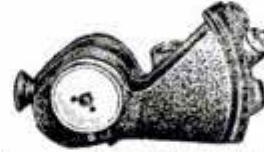
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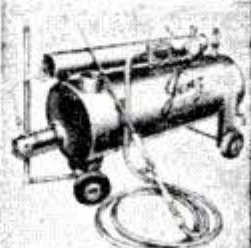
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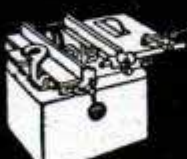
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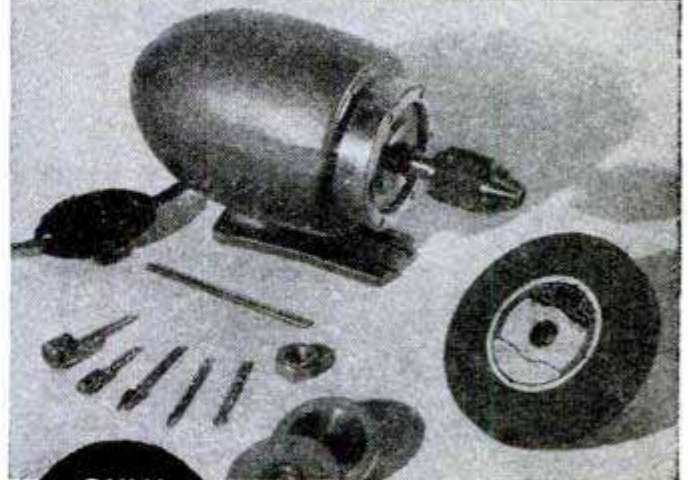
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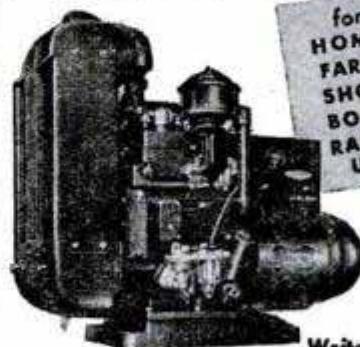
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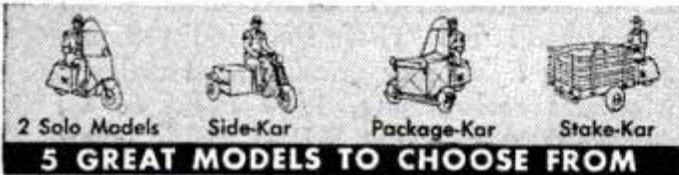
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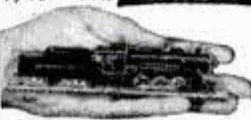
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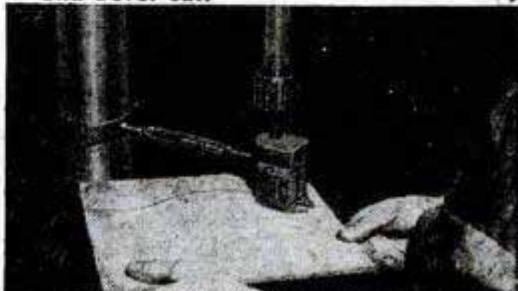
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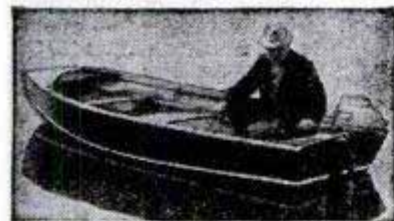
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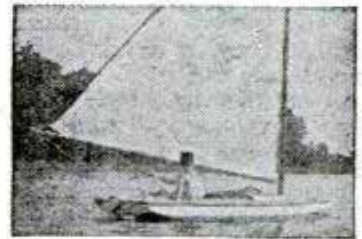


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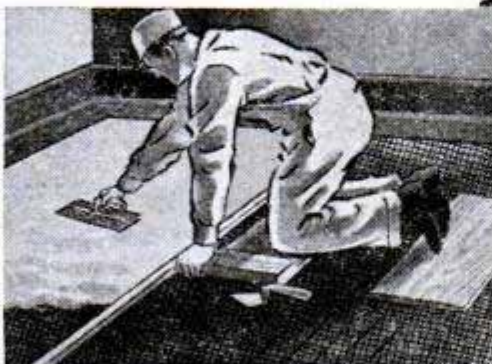
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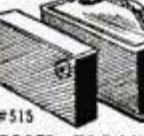
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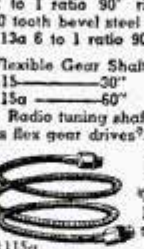
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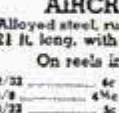
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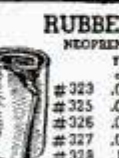
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Capacity 0 to $\frac{1}{2}$ "

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Bench Model . . . 17"
Floor Model . . . 46 $\frac{1}{2}$ "

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10" x 10" . . . Tilt Type

COLUMN

2 $\frac{3}{4}$ " diameter. Accurately ground.

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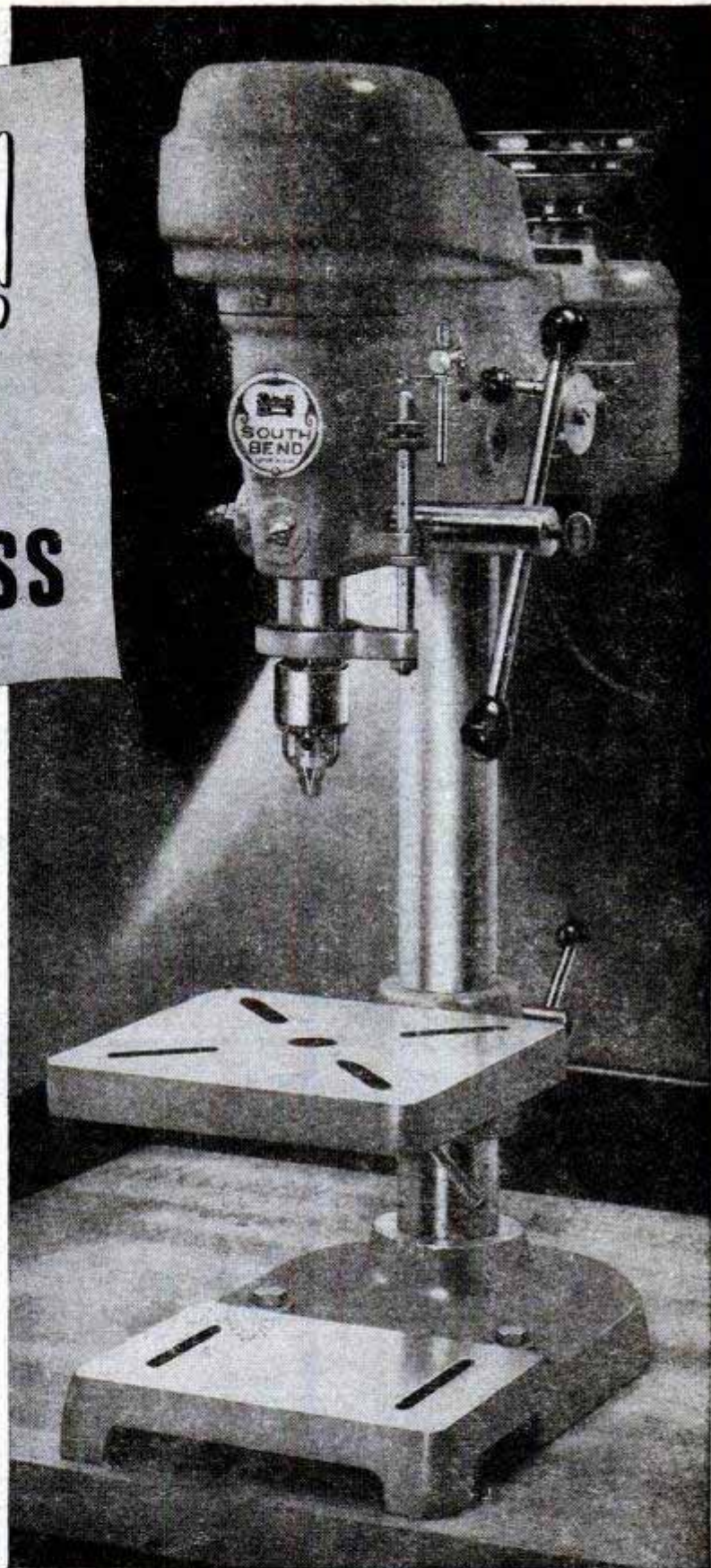
Bench Model . . . 35 $\frac{1}{2}$ "
Floor Model . . . 65 $\frac{1}{2}$ "

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Bench Model . 195 lbs.
Floor Model . 235 lbs.

MOTOR REQUIRED—

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